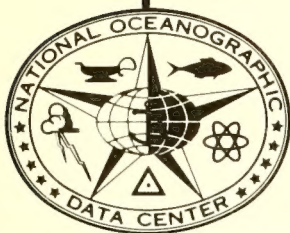


M-2



NATIONAL OCEANOGRAPHIC DATA CENTER

MANUAL SERIES

PROCESSING PHYSICAL AND CHEMICAL DATA FROM OCEANOGRAPHIC STATIONS

PART I
CODING AND KEYPUNCHING

PUBLICATION M-2
(REV. AUG. 1964)

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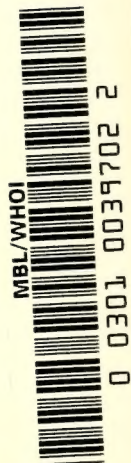
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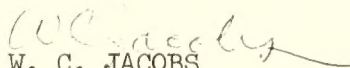
CODING AND KEYPUNCHING

PUBLICATION M-2
(Revised)

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FOREWORD

This publication describes the methods used at the National Oceanographic Data Center (NODC) for coding and punching physical, chemical, and meteorological data collected at oceanographic stations. It is intended also to encourage originators of oceanographic station data to submit their data to the NODC on the standardized coding form devised for this purpose. A description of the NODC cards and listing is included to acquaint the oceanographic community with the format of the archived data.



W. C. JACOBS

Director

National Oceanographic Data Center

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INTRODUCTION

The primary purpose of this manual is to provide the necessary instructions and conversion tables to code and keypunch reduced physical, chemical, and meteorological data collected at oceanographic stations in accordance with the storage-retrieval system developed by the National Oceanographic Data Center (NODC) in conjunction with the oceanographic community.

The punch card format and codes described in this manual are based on the report of the Eastern Pacific Oceanic Conference (EPOC) Committee on Machine Processing for Oceanographic Data; the International Council for the Exploration of the Sea (ICES) oceanographic station card format; the Canadian Oceanographic Data Centre (CODC); and the card format originally used at the U. S. Naval Oceanographic Office (formerly the U. S. Navy Hydrographic Office).

The secondary purpose of this manual is to acquaint the oceanographic community with the format of the processed oceanographic station data in the NODC archives.

Part II of this manual, now in preparation, will contain detailed descriptions of the formulas and techniques used for the interpolations and computations performed by the NODC.

Part III of this manual will contain descriptions of the quality control methods and criteria used in the processing of oceanographic station data.

GENERAL

The punch card used by the NODC is the 80-column, Hollerith punch card. Each column contains ten numerals, 0 through 9, and two additional places above the 0, designated as the 12 punch (also called the y or high overpunch) and the 11 punch (also called the X or low overpunch). Only one number or letter is punched in each column; the 12 punch, 11 punch, and 0 are used in combination with the numerals 1 through 9 to produce letters or various special symbols.

Three basic oceanographic station cards currently are in use at the NODC for recording the physical, chemical, and meteorological data from an oceanographic station. These are the Master Card and two basic types of Detail Cards--the Observed Depth Card and the Standard Depth Card. Actually, a single, multi-purpose card is used on which the three headings are printed; the identification of the card and the headings to be used are indicated by a numeric entry in Column 80. (See Appendix II, page 115 for sample Oceanographic Station Card, Physical and Chemical Data.)

Two distinct sets of punch cards are produced during the processing of oceanographic data at the NODC. One set contains the observed data (or observed data and interpolated data provided by the originator) and serves as the Data Input Deck for the IBM 7074/1401 Computer System used by the NODC. The other deck contains all the information that appears in the Data Input Deck as well as the interpolated and computed values generated by the computer. This second deck eventually becomes the NODC Cruise Archive Deck for oceanographic station data. All station data released in punch card or listing form is based on the Cruise Archive Deck.

The function of the various card types in these decks is as follows:

A. DATA INPUT DECK

1. Master Card (Card Type 1) - This card is used to identify each oceanographic station and to record general surface environmental information obtained at the station.
2. Observed Depth Card (Card Type 3) - This card is punched for each depth at which physical and/or chemical data are reported.
3. Literature Observed Depth Card (Card Type 4) - For some published historical data, the original observed data are no longer available; only the originator's interpolated values are available. This card serves as an Observed Depth Card in the computer system; interpolations and computations are based on data in this card.

B. CRUISE ARCHIVE DECK

1. Master Card (Card Type 1) - This card serves the same function and contains the same information as the Master Card in the Data Input Deck; however, the Master Card in the Cruise Archive Deck contains the Marsden square number computed from the positional information.
2. Observed Depth Cards (Card Types 3 and 4) - In addition to the observed and/or literature interpolated data, these cards contain the computed values of sigma-t (σ_t) and sound velocity.
3. Standard Depth Cards (Card Types 6 and 7) -
 - a. NODC-Produced Standard Depth Card - Card Type 6 is the NODC-produced Standard Depth Card which generally contains the interpolated values of temperature, salinity, and oxygen and the NODC computed values of sigma-t (σ_t), sound velocity, specific volume anomaly, and dynamic depth anomaly.
 - b. Originator's Standard Depth Card - Card Type 7 is the Originator's Standard Depth Card which contains the originator's interpolated values of temperature, salinity, and oxygen.

A Standard Depth Card is produced for each standard depth that occurs above the last valid observed depth and for each observed depth that coincides with a standard depth. Standard depths for which NODC interpolates are:

LIST OF STANDARD DEPTHS (METERS)

0000	0125	0600	1300	4000
0010	0150	0700	1400	5000
0020	0200	0800	1500	6000
0030	0250	0900	1750	7000
0050	0300	1000	2000	8000
0075	0400	1100	2500	9000
0100	0500	1200	3000	

A Cruise Master Card bearing information common to the entire cruise, as well as codes indicating observational techniques and precision, eventually will be provided for each cruise. The format of this card is being developed by the NODC.

To facilitate coding and keypunching of oceanographic station data, NODC issues a standard form, "Physical and Chemical Data Form for Oceanographic Stations" - NODC-EXP-3167/25 (4-64), which contains space for coding the surface environmental information (Master Card) and the subsurface observations (Detail Cards). It is available with a trilingual wrapper carrying instructions on coding the form. The entries on the data form are arranged in essentially the same sequence as they appear on the punch card. Shaded portions of the form are for information normally filled in by the NODC. Data submitted on the NODC Form is generally processed within four to six weeks of receipt. A listing of the fully computed data is sent to the originator; a listing suitable for publication and/or punch cards (Cruise Archive Deck) are available on request.

GENERAL INSTRUCTIONS FOR CODING THE PHYSICAL AND CHEMICAL DATA FORM

The following general instructions are to be applied when coding the data form.

1. Zeros are prefixed to numeric entries where necessary to fill a field; however, zeros should not be suffixed merely to fill a field.
2. Whenever rounding is necessary, the following procedure is to be used:
 - > 5, add one (1) to the preceding numeral
 - < 5, drop
 - 5, round to nearest even numeral
3. Generally, all shaded fields on the coding form are to be left blank; these fields will be completed at the NODC.
4. Arrange depths in order of descending depth; interfile depths from overlapping casts if necessary.
5. Question marks for doubtful data can be entered only in Columns 32, 37, 42, and 53 of the Detail Card portion of the coding form. The originator may, for record purposes, enter additional chemistry with a question mark; however, doubtful additional chemistry cannot be punched.

INSTRUCTIONS FOR CODING THE SURFACE ENVIRONMENTAL INFORMATION (MASTER CARD)

(See Appendix II for sample Physical and Chemical Data Form)

Columns 1-2

COUNTRY CODE

Enter the appropriate country code according to Table 1. This field combined with Cruise Number, Columns 73-75, makes up the five-digit NODC Reference Identity Number. Regardless of the ship's registry, the country code should reflect the nationality of the agency sponsoring or operating the vessel for the particular cruise being coded.

Columns 3-4

SHIP CODE

Do not code this field; the proper code will be entered at the NODC. The complete ship name should be entered in the space provided on the coding form; include ICES numeric ship-platform code if available.

Columns 5-9

LATITUDE

Enter latitude in degrees and minutes. Enter tenths of minutes, when available, in Column 9. Table 2 converts seconds to tenths of a minute. Enter N or S in the space provided on the data form.

Columns 10-15

LONGITUDE

Enter longitude in degrees and minutes. Enter tenths of minutes, when available, in Column 15. Table 2 converts seconds to tenths of a minute. Enter E or W in the space provided on the data form.

Note on Columns 5-15: For station position use location as first determined on arrival at oceanographic station or at time of release of first messenger. If, in the opinion of the originator, appreciable drift occurred during the period while the station was occupied, it should be indicated by an entry in the Remarks space and a red dash in Column 16 of the coding form. If a red dash is entered in Column 16 of the form, X overpunch Column 15 of the card.

Columns 16-18

MARSDEN SQUARE

No entry is required on the coding form; Marsden square is computed at the NODC from the position coordinates entered in Columns 5-15. A Marsden Square Chart, Table 3, is provided for those originators who wish to enter this information on the coding form for their own records.

Columns 19-20

YEAR

Enter last two digits of year as determined by Greenwich Mean Time (GMT).

Columns 21-22

MONTH

Enter month as determined by GMT, using numerals 01 through 12.

Columns 23-24

DAY

Enter day of month as determined by GMT, using numerals 01-31. If one or more oceanographic casts were made on the day prior to the day reported in this field, subtract one day from the station date and enter this date in Columns 23-24. Additionally, 24 hours must be added to the actual station time.

Columns 25-27

TIME

Enter hour and tenths of hour of time of station in GMT. Time normally should represent the time when the surface environmental information was taken, except as mentioned above. Table 4 converts zone time to GMT and Table 2 converts minutes to tenths of an hour. Caution should be exercised when using Table 4, however, as non-standard time zone boundaries are not apparent from this table.

Columns 28-30

ORIGINATOR'S CRUISE NUMBER

Enter the number, alphabetic or alpha-numeric designator or its closest equivalent, assigned to the cruise by the originator. If year is part of cruise number, do not enter year in this field; year precedes cruise number when listed. (See Appendix III.)

EXAMPLE: MRL 5906 = 006

Columns 31-33

ORIGINATOR'S STATION NUMBER

Enter ship's station number as assigned by the originator. When complex station numbering systems are employed (such as station numbers containing positional codes) which require more than three columns to record, continue the remaining numerals or letters in Columns 68-72 of the Special Observations field. However, in these cases, Column 72 may contain a numeral only.

Columns 34-37

DEPTH TO BOTTOM

Enter depth to bottom (sounding) in whole meters (corrected or uncorrected). Table 5 converts fathoms to meters; Table 6 converts feet to meters. Although Table 6 is given to tenths of a meter, values obtained from this table should be rounded to the nearest whole meter. (When soundings are greater than 9999 meters, enter the extra digit in Column 34.)

Columns 38-39

MAXIMUM SAMPLE DEPTH

Enter the depth of the deepest sample (temperature, salinity, or chemical) to the nearest hundred-meter interval. Round as follows:
0-50 = 00, 51-150 = 01, 151-250 = 02, etc.

Columns 40-41

NUMBER OF OBSERVED DEPTHS

Enter the total number of observed sampled depths entered on the detailed portion of the coding form.

Columns 42-45

WATER COLOR AND TRANSPARENCY

Enter water color in Columns 42 and 43 according to the code (based on the Forel-Ule scale) given in Table 7. Additionally, Table 7 converts percent yellow (based on Forel Scale) and percent brown to the proper code. Enter transparency values obtained by using a standard white Secchi disc in whole meters in Columns 44 and 45.

Columns 46-49

WAVE DIRECTION, HEIGHT, AND PERIOD

Enter the direction from which the dominant waves come in Columns 46 and 47 according to the code shown in Table 8. (If wave height is 16 feet or greater, 50 must be added to the code value of direction.) Enter the height of the dominant waves in Column 48 according to WMO Code 1555 shown in Table 10 and cross out the letter A at the top of Column 48. Enter the period of the dominant waves in Column 49 according to WMO Code 3155 shown in Table 11. If Sea State is reported rather than wave height and period, enter the state of sea (or amount) in Column 48 according to WMO Code 3700 as shown in Table 12 and cross out H at the top of Column 48, leaving Column 49 blank.

Columns 50-53

WIND DIRECTION AND SPEED (FORCE)

Enter direction from which the wind blows in Columns 50 and 51 according to the code shown in Table 8. Table 9 is for conversion from points, quarter points, or a scale of 32. There is a choice of entering either wind speed or force in Columns 52-53:

1. Wind speed in knots. Conversions are given in:

Table 13 (meters/second to knots)
Table 14 (miles/hour to knots)
Table 15 (kilometers/hour to knots)
Table 16 (feet/second to knots)

2. Wind force according to the Beaufort scale as defined by Table 17. (Do not use WMO Code 1144.)

IMPORTANT: The unit not used, i.e., speed or force should be crossed out at the top of the column of the data form.

Columns 54-56

BAROMETRIC PRESSURE

Enter barometric pressure in millibars. Enter tens, units, and tenths only. (Example: 1012.62 = 12.6) The recordable range is 945.0 to 1044.9 mbs. Enter pressure falling outside this range in the Remarks space of the data form. Table 18 converts inches to millibars. Table 19 converts millimeters to millibars.

Columns 57-62

AIR TEMPERATURE

Enter the dry bulb temperature in Columns 57-59 and the wet bulb temperature in Columns 60-62 in degrees centigrade to tenths. Indicate negative temperatures by a prominent red dash over the numeral(s) in Column(s) 57 and/or 60. Table 20 converts °F. to °C. If temperatures are reported to whole degrees Fahrenheit, round the centigrade conversions to whole degrees, and leave Columns 59 and/or 62 blank.

Columns 63-64

WEATHER

There is a choice of two types of entries for weather.

1. Enter an X in Column 63 and enter the weather in Column 64 according to the single digit WMO Code 4501 as shown in Table 21. This is the preferred weather code. Conversions from other weather codes are given in Tables 22 and 23.
2. Enter present weather in Columns 63 and 64 according to the two-digit WMO Code 4677 as shown in Table 24. Because code figures 00 through 03 are not descriptive of present weather, Code 4501 is preferred instead of these code figures.

Columns 65-66

CLOUD TYPE AND AMOUNT

Enter type (genus) of cloud in Column 65 according to WMO Code 0500 shown in Table 25.

Enter cloud amount (fraction of the sky covered by clouds) in eights in Column 66 according to WMO Code 2700 shown in Table 26.

Column 67

VISIBILITY

Enter visibility according to WMO Code 4300 shown in Table 27.

Columns 68-72

SPECIAL OBSERVATIONS

Special observations may be entered in this field; however, the originator must indicate in the Remarks space of the data form the nature of the special observations, decimal places, units, and/or codes used. When reporting special observations, enter a red dash in Column 72. As mentioned previously, these columns also may be used for the continuation of the originator's station number when exceeding three digits (see page 7, Columns 31-33, ORIGINATOR'S STATION NUMBER), but in this case no other information may be placed in this field.

Columns 73-80

PROCESSING NUMBERS

No entries are required on the coding form. The Cruise Number (Columns 73-75) is assigned by the NODC. These numbers are unique within each country. The entry in Columns 73-75 is combined with the entry in Columns 1-2 and, together, they comprise the NODC Reference Identity Number.

The NODC assigns numbers to each station consecutively in the order in which they are submitted on the coding form or in the order in which they appear in published source material.

The NODC enters the numeral one (1) in both the coding form and the punch card to identify the station Master Card.

INSTRUCTIONS FOR CODING THE SUBSURFACE OBSERVATIONS (DETAIL CARDS)

(See Appendix II for sample Physical and Chemical Data Form)

Columns 1-24 are omitted from the coding form. The entries for these columns on the Detail Card are identical to the Master Card.

Columns 25-27

MESSENGER TIME

Enter hour and tenths of hour in GMT at time of release of messenger applicable to the observational level. Table 2 converts minutes to tenths of an hour. The time entry also serves to distinguish multiple casts at one station. When a station began on one day continues into the next day, all casts made on the second day should have 24 hours added to the messenger time. If messenger times are not given for multi-cast stations, but individual casts are identified, enter the numeral 1 in Column 27 for all depths of the first cast, a 2 in Column 27 for all depths of the next cast, and 3, 4, etc. for all depths of subsequent casts.

Columns 28-32

DEPTH OF SAMPLE

Enter depth of sample in meters in Columns 28-31. (When sample depths are greater than 9999 meters, enter the extra digit in Column 28.) Column 32 may be used to enter tenths of a meter or a question mark for doubtful depths. To indicate thermometrically determined depths, place a dagger (†) in Column 32 at each depth that both an unprotected thermometer and protected thermometer were used. (The entries in the depth field should be corrected depths only; however, if depth entries are uncorrected "wire-out" depths, enter the letter Z in Column 32 of the coding form.) Standard depths which have not been sampled need not be entered on the data form; interpolated values for these depths are normally computed by NODC. The originator of the data may, however, code his own interpolations at standard depths. The messenger time for these depths must be left blank and the numeral 7 must be entered in Column 80 of the coding form.

Columns 33-37

TEMPERATURE

Enter temperature in °C. to hundredths in Columns 33-36. Column 37 may be used for entering an additional (thousandths) decimal, a precision indicator coded according to Table 28, or a doubtful data indicator (?). To indicate a negative temperature, place a prominent minus sign in red before the numeral entry in Column 33. (Column 33 has extra width for this purpose.)

Columns 38-42

SALINITY

Enter salinity in parts per thousand to hundredths in Columns 38-41; Column 42 may be used for entering an additional (thousandths) decimal, a precision indicator coded according to Table 28, or a doubtful data indicator (?). Table 29 converts chlorinity to salinity.

Columns 43-50 do not appear on the data form. On the punch card these columns are reserved for computed sigma-t (σ_t) and sound velocity. Sound velocities measured by a velocimeter (or temperatures or salinities based on these measurements) should be forwarded or coded separately.

Columns 51-53

OXYGEN

Enter oxygen in milliliters per liter (ml/l) to hundredths in Columns 51-53. (If determined to tenths only leave Column 53 blank.) Table 30 converts milligrams per liter (mg/l) and Table 31 converts milligram-atoms per liter (mg-at/l) to ml/l. To record oxygen values greater than 9.99 ml/l enter two numerals (tens and units) in Column 51.

Columns 54-71

CHEMISTRY

Columns 54-71 are intended for entering the additional chemistry fields described below. These are the only chemistry entries which will be punched routinely. A chemistry card to record chemistry other than that shown below is being developed at the NODC. However, provisionally any chemistry may be substituted in any one of the fields provided that:

1. It can be reported in a three digit field.
2. The proper code in Table 41 is entered in Column 72 to indicate the field in which the substituted chemistry is entered.
3. The nature and units of the substituted chemistry are fully described in the Remarks space of the data form.

Columns 54-56

PHOSPHATE

Enter inorganic phosphate in microgram-atoms per liter ($\mu\text{g-at/l}$) to hundredths. Conversions from other units are shown in Tables 32-34.

Columns 57-59

TOTAL PHOSPHORUS

Enter total P in microgram-atoms per liter ($\mu\text{g-at/l}$) to hundredths.

Columns 60-62

NITRITE-NITROGEN

Enter nitrite-nitrogen ($\text{NO}_2\text{-N}$) in microgram-atoms per liter ($\mu\text{g-at/l}$) to hundredths. Conversions from micrograms per liter of NO_2 and N to microgram-atoms per liter of $\text{NO}_2\text{-N}$ are shown in Tables 35 and 37, respectively.

Columns 63-65

NITRATE-NITROGEN

Enter nitrate-nitrogen ($\text{NO}_3\text{-N}$) in microgram-atoms per liter ($\mu\text{g-at/l}$) to tenths. Conversions from micrograms per liter of NO_3 and N to microgram-atoms per liter of $\text{NO}_3\text{-N}$ are shown in Tables 36 and 37, respectively.

Columns 66-68

SILICATE-SILICON

Enter silicate-silicon in microgram-atoms per liter ($\mu\text{g-at/l}$) to whole units. Conversions from other units are shown in Tables 38-40.

Columns 69-71

pH

Enter pH in Columns 69-71.

Column 72

SUBSTITUTED CHEMISTRY

Enter the appropriate code as given in Table 41 to indicate which chemistry field contains substituted chemistry. If no substitution was made, leave Column 72 blank.

Columns 73-79 are omitted from the data form. The entries in these columns of the Detail Card are identical to the entries in the Master Card; the information must be reproduced in each Detail Card from the Master Card.

For observed sample depths (including those falling at standard depths), enter the numeral 3 in Column 80 to indicate an Observed Depth Card. If an originator wishes to code his own interpolated standard depths, the numeral 7 is entered in Column 80 on the data form for each individual interpolated standard depth. (Computed items such as sigma-t, sound velocity, dynamic depth anomaly, etc. will be computed for this type of card, but computations will be based on the values as reported by the originator.) In a few instances only interpolated data may be available for certain cruises and/or stations. In these instances, the numeral 4 is entered in Column 80. Such a card will be treated by the computer as though it were an observed level.

INSTRUCTIONS FOR PUNCHING NODC OCEANOGRAPHIC STATION CARDS

(See Appendix II, Page 115, for sample Oceanographic Station Card.)

In general, the Physical and Chemical Data Form for Oceanographic Stations is arranged in such a manner that most of the numeric and alphabetic entries can be punched directly into the corresponding columns of the punch card. The alphabetic punch code used at the NODC is the standard letter punch code shown below.

STANDARD LETTER PUNCH CODE

Letter	Punch	Letter	Punch	Letter	Punch
A	12 + 1	J	11 + 1	S	0 + 2
B	12 + 2	K	11 + 2	T	0 + 3
C	12 + 3	L	11 + 3	U	0 + 4
D	12 + 4	M	11 + 4	V	0 + 5
E	12 + 5	N	11 + 5	W	0 + 6
F	12 + 6	O	11 + 6	X	0 + 7
G	12 + 7	P	11 + 7	Y	0 + 8
H	12 + 8	Q	11 + 8	Z	0 + 9
I	12 + 9	R	11 + 9		

Question marks in Columns 32, 37, and 42 of the Detail Cards are punched as the letter Q in the same column.

The correct entry and location for certain 12 and 11 punches cannot readily be determined from the data form. For this reason, the correct entry and location for these punches are given in the special punching instructions below.

MASTER CARD

ENTRY ON DATA FORM

Letter S between Columns 9 and 10

Letter E between Columns 15 and 16

Red dash in Column 16

Numerals 10 in Column 34

Letter H crossed out in columnar heading of Column 48 (letter A not crossed out).

Word SPEED crossed out in columnar heading of Columns 52-53 (word FORCE not crossed out).

Red dash in Column 57

Red dash in Column 60

Red dash in Column 72

ENTRY IN PUNCH CARD

11 punch in Column 8

11 punch in Column 14

11 punch in Column 15

Letter A in Column 34

11 punch in Column 48

11 punch in Column 52

11 punch in Column 59

11 punch in Column 62

11 punch in Column 72

11 punch in Column 80 for data processing machine control.

DETAIL CARDS

CODING FORM

Columns 1-24

Dagger (†) in Column 32

Question mark (?) in Column 32

Red dash in Column 33

Question mark (?) in Column 37

Question mark (?) in Column 42

PUNCH CARD

Same as Master Card

11 punch in Column 31

Letter Q in Column 32

11 punch in Column 36

Letter Q in Column 37

Letter Q in Column 42

DETAIL CARDS (CONT'D)

CODING FORM

Two (2) numerals in Column 51
Question mark (?) in Column 53

PUNCH CARD

11 punch in Column 51
11 punch in Column 53

SUMMARY OF OVERPUNCHES WHICH MAY APPEAR IN THE NODC ARCHIVE DECK

All 11 and 12 punches appearing in the Data Input Deck are reproduced in the Cruise Archive Deck. However, a number of additional 11 punches are generated by the computer during the computation process. A complete list of 11 and 12 punches (other than alphabetic) which may appear in the Oceanographic Station Cards of the Cruise Archive Deck follows:

MASTER CARD (NUMERAL 1 IN COLUMN 80)

<u>Location of Entry in Punch Card</u>	<u>11 Punch and Purpose</u>
Column 8	11 punch to indicate South latitude
Column 14	11 punch to indicate East longitude
Column 15	11 punch to indicate that according to originator, extensive drift occurred while on station.
Column 48	11 punch to indicate that state of the sea (or sea amount) is given rather than wave height and period.
Column 52	11 punch to indicate wind FORCE is given rather than SPEED.
Column 59	11 punch to indicate a negative dry bulb air temperature.
Column 62	11 punch to indicate a negative wet bulb air temperature.
Column 72	11 punch to indicate that a SPECIAL OBSERVATION is reported in Columns 68-72.
Column 80	11 punch in Column 80 for data processing machine control.

OBSERVED DEPTH CARDS (NUMERAL 3 OR 4 IN COLUMN 80)

<u>Location of Entry in Punch Card</u>	<u>11 Punch and Purpose</u>
Column 8	11 punch to indicate South latitude.
Column 14	11 punch to indicate East longitude.
Column 15	11 punch to indicate that according to originator, extensive drift occurred while on station.
Column 31	11 punch to indicate a thermometric depth.
Column 36	11 punch to indicate a negative temperature.
Column 46	11 punch generated by the computer to indicate a negative sigma-t (σ_t).
Column 51	11 punch acts as a control punch so that 10 is added to the oxygen value.
Column 53	11 punch to indicate doubtful oxygen.

STANDARD DEPTH CARDS (NUMERAL 6 OR 7 IN COLUMN 80)

<u>Location of Entry in Punch Card</u>	<u>11 Punch and Purpose</u>
Columns 8, 14, 15, 36, 46, 51, and 53	Same as Observed Depth Card.
Column 59	11 punch generated by the computer to indicate a negative specific volume anomaly.
Column 63	11 punch generated by the computer to indicate a negative dynamic depth anomaly.

EXPLANATION OF THE NODC LISTING FORMAT

Effective August 1963, oceanographic station data processed by NODC are released in a new listing format. It is specifically designed for the printout of the NODC Cruise Archive Deck described in this manual.

Two types of listings are available. The Archive Listing is printed on plain tabulating paper, is used for routine release of data, and is the standard archive shelf product at NODC. Stations are listed in continuous order, with page breaks occurring at random within stations. Columnar headings are not printed; identification of fields is accomplished by use of a template provided with each listing.

The Publication Listing is identical in format but is printed on heavy white paper suitable for photo-offset lithographic reproduction. A clear, plastic-overlay template is provided to identify the fields. Tick marks on both the listing and the template facilitate registry.

An example of the NODC Publication Listing is shown in Appendix III.

The following is a complete description of the entries, units, and codes appearing on all new NODC listings. (See template shown in example of station.)

TOP PART OF TEMPLATE

ENTRY

DESCRIPTION OF FIELD

Reference

NODC Reference Identity Number. Publication C-1, Reference Sources of Oceanographic Station Data, gives complete bibliographic and other pertinent information for each cruise.

Country code

NODC country code. This code (both numeric and alphabetic) indicates nationality of the institution or agency conducting the survey or expedition.

Identity number

A reference archive number assigned by NODC for storage-retrieval purposes.

Ship code

NODC's alphabetic designation of ship's name (or ICES numeric ship code, if available).

ENTRYDESCRIPTION OF FIELDLatitude

In degrees, minutes, and tenths of minutes,
N or S.

Longitude

In degrees, minutes, and tenths of minutes,
E or W.

Drift indicator

The letter D appears in this column if,
according to the originator, extensive drift
occurred while on station.

Marsden square

10°
1°

Marsden square number according to the Marsden
square system. (Appendix I, Table 3.)

Station time
(GMT)

Date and time given by the originator in GMT.

Month

Day

HR. 1/10

Month (GMT)

Day of month (GMT)

GMT to nearest tenth of an hour.

Year

Year.

Originator's

Cruise number

Cruise number, alphabetic or alpha-numeric
designator, as assigned by the originator. If
the year of the cruise forms part of the cruise
numbering system, the year digits are found in
the preceding field.

Station number

Originator's station number or designator.

Depth to Bottom

Corrected or uncorrected sounding depth in meters.
(Read A in first column as 10)

Max. depth of samples

Depth of deepest sample in hundreds of meters to
nearest hundred-meter interval.

ENTRYDESCRIPTION OF FIELDWave observations

Dir.	Direction from which the dominant waves are coming, in tens of degrees, according to WMO Code 0885.
Hgt.	Height of dominant waves according to WMO Code 1555.
Per.	Period of dominant waves according to WMO Code 3155.
Sea amt.	Sea amount (sea state) according to WMO Code 3700 (preceded by letter A).

Weather code

If preceded by the letter X, weather according to WMO Code 4501. A numeric two-digit entry indicates weather according to WMO Code 4677.

Cloud codes

Type	Cloud type according to WMO Code 0500.
Amt.	Cloud amount in eighths according to WMO Code 2700.

NODC station number

This number is assigned by NODC for data storage and retrieval purposes. The reference and NODC station number combined, uniquely define each station in the NODC archives.

CENTER PART OF TEMPLATE

Water

Color code	Water color according to Forel-Ule Code.
Trans. (m)	Transparency in meters as determined by Secchi disc.

ENTRYDESCRIPTION OF FIELDWind

Dir.

Direction from which the wind is blowing, in tens of degrees, according to WMO Code 0877.

Speed or Force

If preceded by letter S, wind speed in knots, if preceded by letter F, wind force in Beaufort Code.

Barometer
(mbs)

Pressure in millibars, tens, units, and tenths shown only.

Air Temp. °C.

Dry bulb

Dry-bulb air temperature in degrees centigrade to tenths.

Wet bulb

Wet bulb air temperature in degrees centigrade to tenths.

Vis. code

Visibility according to WMO Code 4300.

No. of Obs. Levels

Total number of observed levels (depths) comprising the station.

Special observations

Special surface observations. This is a free optional field. Nature of entry in this space will vary with individual cruises. Information concerning entries in this field can be requested from NODC.

BOTTOM PART OF TEMPLATE
(Applies to third and all succeeding lines of listing)

ENTRY

DESCRIPTION OF FIELD

Messenger time

HR. 1/10

Time (GMT) of release of messenger, in hour and tenths of hour, at observed levels. If a multiple cast series extends past midnight, 24 hours are added to the cast time(s) of the casts that are taken during the next day.

OR

Cast No.

Number of cast (not printed when messenger time is given).

Card Type

OBS - Observed (sampled) level.

STD - Standard interpolated depth. Interpolation of temperature, salinity, and oxygen computed by a modified 3-point LaGrange formula.

*STD - Standard depth values interpolated by the originator or hand-interpolated by NODC.

LIT - Interpolated standard depth values; original observed values not available.

NOTE: When a valid observed level coincides with a standard depth level, both the OBS and STD lines will appear.

Depth (m)

Depth of sample (or standard level depth) in meters. A numeric entry of tenths of meters appears as the fifth digit of the depth field. Postscript T indicates a depth at which both a protected and an unprotected thermometer were used. Subscript Q indicates that the value is marked doubtful by the originator. A value designated as potentially implausible by NODC is marked with a P. Z indicates uncorrected "wire out" depth.

ENTRYDESCRIPTION OF FIELDT °C

Temperature in degrees centigrade to hundredths; a thousandths place appears as a fifth numeral. (For Q or P notation, see Depth field.) For alphabetic precision entry, see Table 28.

S ‰

Salinity in parts per thousand (ppt) to hundredths of ppt. A thousandth of a ppt appears as a fifth numeral. (For Q and P notation, see Depth field.) For alphabetic precision code, see Table 28.

SIGMA-T

Sea water density expressed as sigma-t (σ_t) to hundredths (g/l-1000). When temperature and/or salinity is marked doubtful, P, Q, or * is suffixed to σ_t .

Specific volume
anomaly - X 10⁷

Specific volume anomaly in (cm³/gm) X 10⁷.
Appears at standard depths only.

$\Sigma\Delta D$
Dyn. M.
X 10³

Dynamic depth anomaly in dynamic meters X 10³.
Appears at standard depths only.

Sound Velocity

In meters per second to tenths of a meter, according to Wilson's formula.

NOTE: In the following designations, the character "l" stands for a small letter "L" denoting liter.

O₂ ml/l

Oxygen in ml/l to hundredths. Q indicates doubtful value as determined by either the originator or the NODC.

PO₄-P
µg-at/l

Inorganic phosphate in microgram-atoms per liter of P to hundredths.

ENTRYDESCRIPTION OF FIELDTotal-P
µg-at/l

Total phosphorus in microgram-atoms per liter of P to hundredths.

NO₂-N
µg-at/l

Nitrites in microgram-atoms per liter of N to hundredths.

NO₃-N
µg-at/l

Nitrates in microgram-atoms per liter of N to tenths.

SiO₄-Si
µg-at/l

Silicates in microgram-atoms per liter of Si.

pH

pH to hundredths.

- NOTE: (1) Notation TRC in chemistry fields indicates report of trace or a value less than 1 in the last column.
- (2) A numeral appearing two spaces beyond the pH column is an Optional Chemistry Substitution code. The optional chemistry fields are numbered from left to right beginning with PO₄-P = 1 through pH = 6. The code numeral indicates that the entry in the respective field is NOT as given on the template. (A special template with the correct field designator will be furnished for publication purposes by special request only.)

APPENDIX I

Conversion Tables

TABLE 1

NODC COUNTRY CODE

<u>CODE</u>	<u>NAME</u>
08	Argentina
09	Australia
10	Austria
11	Belgium
14	Brazil
18	Canada
19	Ceylon
20	Chile
21	China
22	Colombia
RC	Congo (BRAZZAVILLE)
26	Denmark
34	Finland
35	France
06	Germany
GH	Ghana
36	Greece
46	Iceland
41	India
42	Indonesia
45	Ireland
47	Israel
48	Italy
IC	Ivory Coast
49	Japan
24	Korea
64	Netherlands
59	New Caledonia
61	New Zealand
NI	Nigeria
58	Norway

TABLE 1 (Cont'd)

<u>CODE</u>	<u>NAME</u>
62	Pakistan
65	Peru
66	Philippines
67	Poland
68	Portugal
91	South Africa
90	Soviet Union
29	Spain
77	Sweden
86	Thailand
89	Turkey
27	United Arab Republic
31	United Kingdom
31	United States
93	Venezuela
95	Yugoslavia

NOTE: Other country codes will be added to this list as needed.

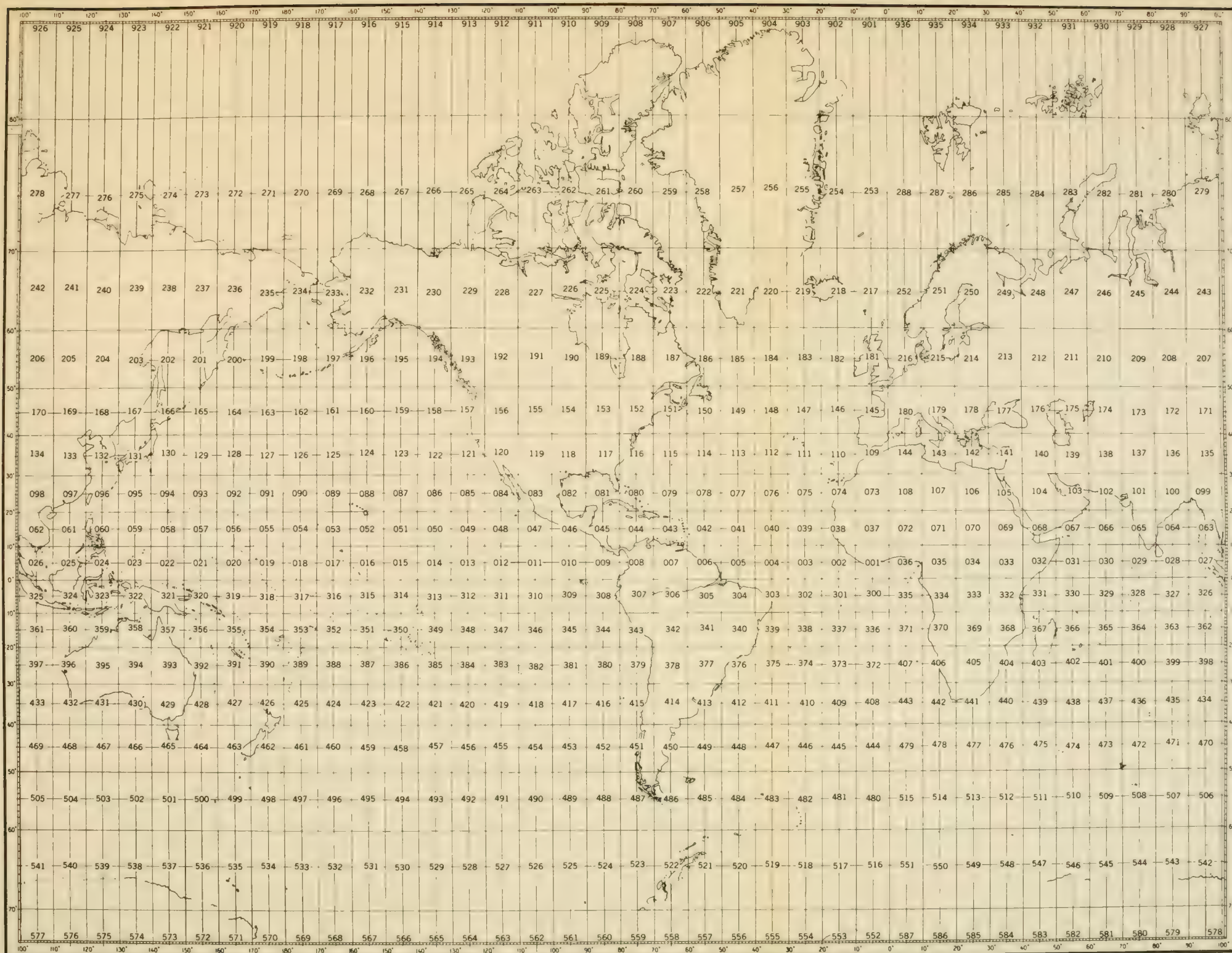
TABLE 2

Tenths Conversion

Conversion from seconds (of position) or minutes (of time)
to tenths of minutes or hour

Range of Secs. or Mins.	Tenths of Mins. or Hrs.
00 - 05	0
06 - 11	1
12 - 17	2
18 - 23	3
24 - 29	4
30 - 35	5
36 - 41	6
42 - 47	7
48 - 53	8
54 - 59	9

TABLE 3 (a)



MARDEN SQUARE CHART

EAST LONGITUDE

PRECEDING DAY

If day change (diagonal) line is crossed from right to left, subtract one day; from left to right, add one day.

To convert from local time to any other time, locate local time in zone column and proceed horizontally to zone wanted. Example 05 in L (-11) time is 18 GkT of preceding day.

TABLE 4

TABLE 5

Depth

Conversion from fathoms to meters
(1 fathom = 1.8288 meters)

Fathoms	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
Meters	0	0	0	1	1	1	1	1	1	2
Fathoms	0	1	2	3	4	5	6	7	8	9
00	0000	0002	0004	0005	0007	0009	0011	0013	0015	0016
10	0018	0020	0022	0024	0026	0027	0029	0031	0033	0035
20	0037	0038	0040	0042	0044	0046	0048	0049	0051	0053
30	0055	0057	0059	0060	0062	0064	0066	0068	0069	0071
40	0073	0075	0077	0079	0080	0082	0084	0086	0088	0090
50	0091	0093	0095	0097	0099	0101	0102	0104	0106	0108
60	0110	0112	0113	0115	0117	0119	0121	0123	0124	0126
70	0128	0130	0132	0134	0135	0137	0139	0141	0143	0144
80	0146	0148	0150	0152	0154	0155	0157	0159	0161	0163
90	0165	0166	0168	0170	0172	0174	0176	0177	0179	0181
100	0183	0185	0187	0188	0190	0192	0194	0196	0198	0199
110	0201	0203	0205	0207	0208	0210	0212	0214	0216	0128
120	0219	0221	0223	0225	0227	0229	0230	0232	0234	0236
130	0238	0240	0241	0243	0245	0247	0249	0251	0252	0254
140	0256	0258	0260	0262	0263	0265	0267	0269	0271	0272
150	0274	0276	0278	0280	0282	0283	0285	0287	0289	0291
160	0293	0294	0296	0298	0300	0302	0304	0305	0307	0309
170	0311	0313	0315	0316	0318	0320	0322	0324	0326	0327
180	0329	0331	0333	0335	0336	0338	0340	0342	0344	0346
190	0347	0349	0351	0353	0355	0357	0358	0360	0362	0364
200	0366	0368	0369	0371	0373	0375	0377	0379	0380	0382
210	0384	0386	0388	0390	0391	0393	0395	0397	0399	0401
220	0402	0404	0406	0408	0410	0411	0413	0415	0417	0419
230	0421	0422	0424	0426	0428	0430	0432	0433	0435	0437
240	0439	0441	0443	0444	0446	0448	0450	0452	0454	0455
250	0457	0459	0461	0463	0465	0466	0468	0470	0472	0474
260	0475	0477	0479	04 81	0483	0485	0486	0488	0490	0492
270	0494	0496	0497	0499	0501	0503	0505	0507	0508	0510
280	0512	0514	0516	0518	0519	0521	0523	0525	0527	0529
290	0530	0532	0534	0536	0538	0539	0541	0543	0545	0547

TABLE 5 (Cont'd)

Depth

Conversion from fathoms to meters
(1 fathom = 1.8288 meters)

Fathoms	00	10	20	30	40	50	60	70	80	90
300	0549	0567	0585	0604	0622	0640	0658	0677	0695	0713
400	0732	0750	0768	0786	0805	0823	0841	0860	0878	0896
500	0914	0933	0951	0969	0988	1006	1024	1042	1061	1079
600	1097	1116	1134	1152	1170	1189	1207	1225	1244	1262
700	1280	1298	1317	1335	1353	1372	1390	1408	1426	1445
800	1463	1481	1500	1518	1536	1554	1573	1591	1609	1628
900	1646	1664	1682	1701	1719	1737	1756	1774	1792	1811

Fathoms	000	100	200	300	400	500	600	700	800	900
1000	1829	2012	2195	2377	2560	2743	2926	3109	3292	3475
2000	3658	3840	4023	4206	4389	4572	4755	4938	5121	5304
3000	5486	5669	5852	6035	6218	6401	6584	6767	6949	7132
4000	7315	7498	7681	7864	8047	8230	8412	8595	8778	8961
5000	9144	9327	9510	9693	9876	10058	10241	10424	10607	10790

TABLE 6

Depth

Conversion from feet to meters (tenths)
(1 foot = 0.3048 meter)

Feet	0	1	2	3	4	5	6	7	8	9
00	0.0	0.3	0.6	0.9	1.2	1.5	1.8	2.1	2.4	2.7
10	3.0	3.4	3.7	4.0	4.3	4.6	4.9	5.2	5.5	5.8
20	6.1	6.4	6.7	7.0	7.3	7.6	7.9	8.2	8.5	8.8
30	9.1	9.4	9.8	10.1	10.4	10.7	11.0	11.3	11.6	11.9
40	12.2	12.5	12.8	13.1	13.4	13.7	14.0	14.3	14.6	14.9
50	15.2	15.5	15.8	16.2	16.5	16.8	17.1	17.4	17.7	18.0
60	18.3	18.6	18.9	19.2	19.5	19.8	20.1	20.4	20.7	21.0
70	21.3	21.6	21.9	22.3	22.6	22.9	23.2	23.5	23.8	24.1
80	24.4	24.7	25.0	25.3	25.6	25.9	26.2	26.5	26.8	27.1
90	27.4	27.7	28.0	28.3	28.7	29.0	29.3	29.6	29.9	30.2
100	30.5	30.8	31.1	31.4	31.7	32.0	32.3	32.6	32.9	33.2
110	33.5	33.8	34.1	34.4	34.7	35.1	35.4	35.7	36.0	36.3
120	36.6	36.9	37.2	37.5	37.8	38.1	38.4	38.7	39.0	39.3
130	39.6	39.9	40.2	40.5	40.8	41.1	41.5	41.8	42.1	42.4
140	42.7	43.0	43.3	43.6	43.9	44.2	44.5	44.8	45.1	45.4
150	45.7	46.0	46.3	46.6	46.9	47.2	47.5	47.9	48.2	48.5
160	48.8	49.1	49.4	49.7	50.0	50.3	50.6	50.9	51.2	51.5
170	51.8	52.1	52.4	52.7	53.0	53.3	53.6	53.9	54.3	54.6
180	54.9	55.2	55.5	55.8	56.1	56.4	56.7	57.0	57.3	57.6
190	57.9	58.2	58.5	58.8	59.1	59.4	59.7	60.0	60.4	60.7
200	61.0	61.3	61.6	61.9	62.2	62.5	62.8	63.1	63.4	63.7
210	64.0	64.3	64.6	64.9	65.2	65.5	65.8	66.1	66.4	66.8
220	67.1	67.4	67.7	68.0	68.3	68.6	68.9	69.2	69.5	69.8
230	70.1	70.4	70.7	71.0	71.3	71.6	71.9	72.2	72.5	72.8
240	73.2	73.5	73.8	74.1	74.4	74.7	75.0	75.3	75.6	75.9
250	76.2	76.5	76.8	77.1	77.4	77.7	78.0	78.3	78.6	78.9
260	79.2	79.6	79.9	80.2	80.5	80.8	81.1	81.4	81.7	82.0
270	82.3	82.6	82.9	83.2	83.5	83.8	84.1	84.4	84.7	85.0
280	85.3	85.6	86.0	86.3	86.6	86.9	87.2	87.5	87.8	88.1
290	88.4	88.7	89.0	89.3	89.6	89.9	90.2	90.5	90.8	91.1

TABLE 6 (Cont'd)

Conversion from feet to meters (tenths)
(1 foot = 0.3048 meter)

Feet	00	10	20	30	40	50	60	70	80	90
300	91.4	94.5	97.5	100.6	103.6	106.7	109.7	112.8	115.8	118.9
400	121.9	125.0	128.0	131.1	134.1	137.2	140.2	143.3	146.3	149.4
500	152.4	155.4	158.5	161.5	164.6	167.6	170.7	173.7	176.8	179.8
600	182.9	185.9	189.0	192.0	195.1	198.1	201.2	204.2	207.3	210.3
700	213.4	216.4	219.5	222.5	225.6	228.6	231.6	234.7	237.7	240.8
800	243.8	246.9	249.9	253.0	256.0	259.1	262.1	265.2	268.2	271.3
900	274.3	277.4	280.4	283.5	286.5	289.6	292.6	295.7	298.7	301.8
1000	304.8	307.8	310.9	313.9	317.0	320.0	323.1	326.1	329.2	332.2
1100	335.3	338.3	341.4	344.4	347.5	350.5	353.6	356.6	359.7	362.7
1200	365.8	368.8	371.9	374.9	378.0	381.0	384.0	387.1	390.1	393.2
1300	396.2	399.3	402.3	405.3	408.4	411.5	414.5	417.6	420.6	423.7
1400	426.7	429.8	432.8	435.9	438.9	442.0	445.0	448.1	451.1	454.2
1500	457.2	460.2	463.3	466.3	469.4	472.4	475.5	478.5	481.6	484.6
1600	487.7	490.7	493.8	496.8	499.9	502.9	506.0	509.0	512.1	515.1
1700	518.2	521.2	524.3	527.3	530.4	533.4	536.4	539.5	542.5	545.6
1800	548.6	551.7	554.7	557.8	560.8	563.9	566.9	570.0	573.0	576.1
1900	579.1	582.2	585.2	588.3	591.3	594.4	597.4	600.5	603.5	606.6
2000	609.6	612.6	615.7	618.7	621.8	624.8	627.9	630.9	634.0	637.0
2100	640.1	643.1	646.2	649.2	652.3	655.3	658.4	661.4	664.5	667.5
2200	670.6	673.6	676.7	679.7	682.8	685.8	688.8	691.9	694.9	698.0
2300	701.0	704.1	707.1	710.2	713.2	716.3	719.3	722.4	725.4	728.5
2400	731.5	734.6	737.6	740.7	743.7	746.8	749.8	752.9	755.9	759.0
2500	762.0	765.0	768.1	771.1	774.2	777.2	780.3	783.3	786.4	789.4
2600	792.5	795.5	798.6	801.6	804.7	807.7	810.8	813.8	816.9	819.9
2700	823.0	826.0	829.1	832.1	835.2	838.2	841.2	844.3	847.3	850.4
2800	853.4	856.5	859.5	862.6	865.6	868.7	871.7	874.8	877.8	880.9
2900	883.9	887.0	890.0	893.1	896.1	899.2	902.2	905.3	908.3	911.4
3000	914.4	917.4	920.5	923.5	926.6	929.6	932.7	935.7	938.8	941.8
3100	944.9	947.9	951.0	954.0	957.1	960.1	963.2	966.2	969.3	972.3
3200	975.4	978.4	981.5	984.5	987.6	990.6	993.6	996.7	999.7	1002.8

TABLE 7

Water Color

Forel-Ule scale and conversions from percent yellow and percent brown scales

Percent Yellow	Percent Brown	Forel-Ule Scale	Code
0		I	01
2		II	02
5		III	03
9		IV	04
14		V	05
20		VI	06
27		VII	07
35		VIII	08
44		IX	09
54		X	10
65	0	XI	11
	2	XII	12
	5	XIII	13
	9	XIV	14
	14	XV	15
	20	XVI	16
	27	XVII	17
	35	XVIII	18
	44	XIX	19
	54	XX	20
	65	XXI	21

TABLE 8

Direction

In tens of degrees from which waves and/or winds
are coming

Code		Code	
00	Calm (no waves – no motion)	22	215° – 224°
01	5° – 14°	23	225° – 234°
02	15° – 24°	24	235° – 244°
03	25° – 34°	25	245° – 254°
04	35° – 44°	26	255° – 264°
05	45° – 54°	27	265° – 274°
06	55° – 64°	28	275° – 284°
07	65° – 74°	29	285° – 294°
08	75° – 84°	30	295° – 304°
09	85° – 94°	31	305° – 314°
10	95° – 104°	32	315° – 324°
11	105° – 114°	33	325° – 334°
12	115° – 124°	34	335° – 344°
13	125° – 134°	35	345° – 354°
14	135° – 144°	36	355° – 4°
15	145° – 154°	49	Waves confused, direction indeterminate (waves equal to or less than 4¾ metres)
16	155° – 164°	99	{ Waves confused, direction indeterminate (waves greater than 4¾ metres)
17	165° – 174°		
18	175° – 184°		{ Winds variable, or all directions or unknown
19	185° – 194°		
20	195° – 204°		
21	205° – 214°		

Table 8 is a combination of WMO Codes 0885 and 0877.

TABLE 9

Direction

Conversion from points, quarter points, or a scale of 32, to a scale of 36 points

POINTS	QUARTER POINTS	0-32	CODE	POINTS	QUARTER POINTS	0-32	CODE
N x E	N6E to N14E	1	01	S x W	S6W to S14W	17	19
NNE	N15E to N25E	2	02	SSW	S15W to S25W	18	20
NE x N	N26E to N34E	3	03	SW x S	S26W to S34W	19	21
NE	N35E to N45E	4	04	SW	S35W to S45W	20	22
	N46E to N54E		05		S46W to S54W		23
NE x E	N55E to N65E	5	06	SW x W	S55W to S65W	21	24
ENE	N66E to N74E	6	07	WSW	S66W to S74W	22	25
E x N	N75E to N85E	7	08	W x S	S75W to S85W	23	26
	N86E to N89E		09		S86W to S89W		27
E	E	8	09	W	W	24	27
	S89E to S86E		09		N89W to N86W		27
E x S	S85E to S75E	9	10	W x N	N85W to N75W	25	28
ESE	S74E to S66E	10	11	WNW	N74W to N66W	26	29
SE x E	S65E to S55E	11	12	NW x W	N65W to N55W	27	30
	S54E to S46E		13		N54W to N46W		31
SE	S45E to S35E	12	14	NW	N45W to N35W	28	32
SE x S	S34E to S26E	13	15	NW x N	N34W to N26W	29	33
SSE	S25E to S15E	14	16	NNW	N25W to N15W	30	34
S x E	S14E to S6E	15	17	N x W	N14W to N6W	31	35
	S5E to S1E		18		N5W to N1W		36
S	S	16	18	N	N	32	36
	S1W to S5W		18		N1E to N5E		36
				Variable			99

TABLE 10

Height

WMO Code 1555 for recording height of the dominant waves

Code		Code	If 50 is added to direction
0	Less than $\frac{1}{4}$ m (1 ft)	0	5 m (16 ft)
1	$\frac{1}{2}$ m (1 $\frac{1}{2}$ ft)	1	5 $\frac{1}{2}$ m (17 $\frac{1}{2}$ ft)
2	1 m (3 ft)	2	6 m (19 ft)
3	1 $\frac{1}{2}$ m (5 ft)	3	6 $\frac{1}{2}$ m (21 ft)
4	2 m (6 $\frac{1}{2}$ ft)	4	7 m (22 $\frac{1}{2}$ ft)
5	2 $\frac{1}{2}$ m (8 ft)	5	7 $\frac{1}{2}$ m (24 ft)
6	3 m (9 $\frac{1}{2}$ ft)	6	8 m (25 $\frac{1}{2}$ ft)
7	3 $\frac{1}{2}$ m (11 ft)	7	8 $\frac{1}{2}$ m (27 ft)
8	4 m (13 ft)	8	9 m (29 ft)
9	4 $\frac{1}{2}$ m (14 ft)	9	9 $\frac{1}{2}$ m (30 $\frac{1}{2}$ ft)
x	Height not determined		

Notes :

- (1) Each code figure provides for reporting a range of heights. For example : 1 = $\frac{1}{4}$ m (1 ft) to $\frac{3}{4}$ m (2 $\frac{1}{2}$ ft) ; 5 = 2 $\frac{1}{4}$ m (7 ft) to 2 $\frac{3}{4}$ m (9 ft) ; 9 = 4 $\frac{1}{4}$ m (13 $\frac{1}{2}$ ft) to 4 $\frac{3}{4}$ m (15 ft), etc.
- (2) If a wave height comes exactly midway between the heights corresponding to two code figures, the lower code figure is reported ; e.g. a height of 2 $\frac{3}{4}$ m is reported by code figure 5.
- (3) In aeronautical forecast codes, only the left-hand table is to be used and code figure 9 has the meaning : 4 $\frac{1}{2}$ m (14 ft) or more.
- (4) The average value of the wave height (vertical distance between trough and crest) is reported, as obtained from the larger well formed waves of the wave system being observed.

TABLE 11

Period

WMO Code 3155 for recording period of dominant waves

Code		Code	
2	5 seconds or less	8	16 or 17 seconds
3	6 or 7 seconds	9	18 or 19 seconds
4	8 or 9 seconds	0	20 or 21 seconds
5	10 or 11 seconds	1	Over 21 seconds
6	12 or 13 seconds	x	Calm, or period not determined
7	14 or 15 seconds		

Notes:

- (1) The period of the waves is the time between the passage of two successive wave crests past a fixed point (it is equal to the wave length divided by the wave speed).
- (2) The average value of the wave period is reported, as obtained from the larger well-formed waves of the wave system being observed.

TABLE 12

Sea State

WMO Code 3700 for Recording Sea State

Description	Height (†)		Code
	Feet*	Meters	
Calm-glassy	0	0	0
Calm-rippled	0 - $\frac{1}{3}$	0 - 0.1	1
Smooth-wavelet	$\frac{1}{3}$ - $1\frac{2}{3}$	0.1 - 0.5	2
Slight	$1\frac{2}{3}$ - 4	0.5 - 1.25	3
Moderate	4 - 8	1.25 - 2.5	4
Rough	8 - 13	2.5 - 4	5
Very rough	13 - 20	4 - 6	6
High	20 - 30	6 - 9	7
Very high	30 - 45	9 - 14	8
Phenomenal	> 45	> 14	9

(†) The average wave height as obtained from the larger well-formed waves of the wave system being observed.

* The exact bounding height is to be assigned for the lower code figure, e.g. a height of 4 meters is coded as 5.

TABLE 13

Wind Speed

Conversion from meters per second to knots
 (1m/sec = 1.94254 knots)

m/sec	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
knots	0	0	0	1	1	1	1	1	2	2

m/sec	00	01	02	03	04	05	06	07	08	09
00	00	02	04	06	08	10	12	14	16	17
10	19	21	23	25	27	29	31	33	35	37
20	39	41	43	45	47	49	51	52	54	56
30	58	60	62	64	66	68	70	72	74	76
40	78	80	82	84	85	87	89	91	93	95
50	97	99	101	103	105	107	109	111	113	115

TABLE 14

Wind Speed

Conversion from miles per hour to knots
(1 mph = 0.86839 knot)

mph	00	01	02	03	04	05	06	07	08	09
00	00	01	02	03	03	04	05	06	07	08
10	09	10	10	11	12	13	14	15	16	16
20	17	18	19	20	21	22	23	23	24	25
30	26	27	28	29	30	30	31	32	33	34
40	35	36	36	37	38	39	40	41	42	43
50	43	44	45	46	47	48	49	49	50	51
60	52	53	54	55	56	56	57	58	59	60
70	61	62	63	63	64	65	66	67	68	69
80	69	70	71	72	73	74	75	76	76	77
90	78	79	80	81	82	82	83	84	85	86
100	87	88	89	89	90	91	92	93	94	95
110	96	96	97	98	99	100	101	102	102	103

TABLE 15

Wind Speed

Conversion from kilometers per hour to knots
(1 km/hr = 0.539593 knot)

km/hr	00	01	02	03	04	05	06	07	08	09
00	00	01	01	02	02	03	03	04	04	05
10	05	06	06	07	08	08	09	09	10	10
20	11	11	12	12	13	13	14	15	15	16
30	16	17	17	18	18	19	19	20	21	21
40	22	22	23	23	24	24	25	25	26	26
50	27	28	28	29	29	30	30	31	31	32
60	32	33	33	34	35	35	36	36	37	37
70	38	38	39	39	40	40	41	42	42	43
80	43	44	44	45	45	46	46	47	47	48
90	49	49	50	50	51	51	52	52	53	53
100	54	54	55	56	56	57	57	58	58	59
110	59	60	60	61	62	62	63	63	64	64
120	65	65	66	66	67	67	68	69	69	70
130	70	71	71	72	72	73	73	74	74	75
140	76	76	77	77	78	78	79	79	80	80
150	81	81	82	83	83	84	84	85	85	86
160	86	87	87	88	88	89	90	90	91	91
170	92	92	93	93	94	94	95	96	96	97
180	97	98	98	99	99	100	100	101	101	102

TABLE 16

Wind Speed

Conversion from feet per second to knots
(1 ft/sec = 0.5921 knot)

ft/sec	00	01	02	03	04	05	06	07	08	09
00	00	01	01	02	02	03	04	04	05	05
10	06	07	07	08	08	09	09	10	11	11
20	12	12	13	14	14	15	15	16	17	17
30	18	18	19	20	20	21	21	22	22	23
40	24	24	25	25	26	27	27	28	28	29
50	30	30	31	31	32	33	33	34	34	35
60	36	36	37	37	38	38	39	40	40	41
70	41	42	43	43	44	44	45	46	46	47
80	47	48	49	49	50	50	51	52	52	53
90	53	54	54	55	56	56	57	57	58	59
100	59	60	60	61	62	62	63	63	64	65
110	65	66	66	67	67	68	69	69	70	70
120	71	72	72	73	73	74	75	75	76	76
130	77	78	78	79	79	80	81	81	82	82
140	83	83	84	85	85	86	86	87	88	88
150	89	89	90	91	91	92	92	93	94	94
160	95	95	96	97	97	98	98	99	99	100

TABLE 17

Wind Force

Conversion from knots, meters per second, kilometers per hour, and miles per hour to the Beaufort wind scale

CODE	DESCRIPTIVE TERM	VELOCITY EQUIVALENT AT A STANDARD HEIGHT OF 10 METERS ABOVE OPEN FLAT GROUND			
		mean velocity in knots	meters/sec	km/h	m.p.h.
0	Calm	< 1	0 - 0.2	< 1	< 1
1	Light air	1 - 3	0.3 - 1.5	1 - 5	1 - 3
2	Light breeze	4 - 6	1.6 - 3.3	6 - 11	4 - 7
3	Gentle breeze	7 - 10	3.4 - 5.4	12 - 19	8 - 12
4	Moderate breeze	11 - 16	5.5 - 7.9	20 - 28	13 - 18
5	Fresh breeze	17 - 21	8.0 - 10.7	29 - 38	19 - 24
6	Strong breeze	22 - 27	10.8 - 13.8	39 - 49	25 - 31
7	Near gale	28 - 33	13.9 - 17.1	50 - 61	32 - 38
8	Gale	34 - 40	17.2 - 20.7	62 - 74	39 - 46
9	Strong gale	41 - 47	20.8 - 24.4	75 - 88	47 - 54
10	Storm	48 - 55	24.5 - 28.4	89 - 102	55 - 63
11	Violent storm	56 - 63	28.5 - 32.6	103 - 117	64 - 72
12	Hurricane	64 - 71	32.7 - 36.9	118 - 133	73 - 82
13	—	72 - 80	37.0 - 41.4	134 - 149	83 - 92
14	—	81 - 89	41.5 - 46.1	150 - 166	93 - 103
15	—	90 - 99	46.2 - 50.9	167 - 183	104 - 114
16	—	100 - 108	51.0 - 56.0	184 - 201	115 - 125
17	—	109 - 118	56.1 - 61.2	202 - 220	126 - 136

TABLE 18

Atmospheric Pressure

Conversion from inches of mercury to millibars*
(1 inch of H_g = 33.8639 mbs)

Inches	.00	.01	.02	.03	.04	.05	.06	.07	.08	.09
27.9	44.8	45.1	45.5	45.8	46.2	46.5	46.8	47.2	47.5	47.9
28.0	48.2	48.5	48.9	49.2	49.5	49.9	50.2	50.6	50.9	51.2
28.1	51.6	51.9	52.3	52.6	52.9	53.3	53.6	53.9	54.3	54.6
28.2	55.0	55.3	55.6	56.0	56.3	56.7	57.0	57.3	57.7	58.0
28.3	58.3	58.7	59.0	59.4	59.7	60.0	60.4	60.7	61.1	61.4
28.4	61.7	62.1	62.4	62.8	63.1	63.4	63.8	64.1	64.4	64.8
28.5	65.1	65.5	65.8	66.1	66.5	66.8	67.2	67.5	67.8	68.2
28.6	68.5	68.8	69.2	69.5	69.9	70.2	70.5	70.9	71.2	71.6
28.7	71.9	72.2	72.6	72.9	73.2	73.6	73.9	74.3	74.6	74.9
28.8	75.3	75.6	76.0	76.3	76.6	77.0	77.3	77.7	78.0	78.3
28.9	78.7	79.0	79.3	79.7	80.0	80.4	80.7	81.0	81.4	81.7
29.0	82.1	82.4	82.7	83.1	83.4	83.7	84.1	84.4	84.8	85.1
29.1	85.4	85.8	86.1	86.5	86.8	87.1	87.5	87.8	88.1	88.5
29.2	88.8	89.2	89.5	89.8	90.2	90.5	90.9	91.2	91.5	91.9
29.3	92.2	92.6	92.9	93.2	93.6	93.9	94.2	94.6	94.9	95.3
29.4	95.6	95.9	96.3	96.6	97.0	97.3	97.6	98.0	98.3	98.6
29.5	99.0	99.3	99.7	00.0	00.3	00.7	01.0	01.4	01.7	02.0
29.6	02.4	02.7	03.0	03.4	03.7	04.1	04.4	04.7	05.1	05.4
29.7	05.8	06.1	06.4	06.8	07.1	07.5	07.8	08.1	08.5	08.8
29.8	09.1	09.5	09.8	10.2	10.5	10.8	11.2	11.5	11.9	12.2
29.9	12.5	12.9	13.2	13.5	13.9	14.2	14.6	14.9	15.2	15.6
30.0	15.9	16.3	16.6	16.9	17.3	17.6	17.9	18.3	18.6	19.0
30.1	19.3	19.6	20.0	20.3	20.7	21.0	21.3	21.7	22.0	22.4
30.2	22.7	23.0	23.4	23.7	24.0	24.4	24.7	25.1	25.4	25.7
30.3	26.1	26.4	26.8	27.1	27.4	27.8	28.1	28.4	28.8	29.1
30.4	29.5	29.8	30.1	30.5	30.8	31.2	31.5	31.8	32.2	32.5
30.5	32.8	33.2	33.5	33.9	34.2	34.5	34.9	35.2	35.6	35.9
30.6	36.2	36.6	36.9	37.3	37.6	37.9	38.3	38.6	38.9	39.3
30.7	39.6	40.0	40.3	40.6	41.0	41.3	41.7	42.0	42.3	42.7
30.8	43.0	43.3	43.7	44.0	44.4	44.7	45.0	45.4	45.7	46.1
30.9	46.4	46.7	47.1	47.4	47.7	48.1	48.4	48.8	49.1	49.4
31.0	49.8	50.1	50.5	50.8	51.1	51.5	51.8	52.2	52.5	52.8

*The hundreds and thousands digits are not recorded; the true range of this table is 944.8 - 1052.8 mbs.

TABLE 19

Atmospheric Pressure

Conversion from millimeters of mercury to millibars*
(1 mm of Hg = 1.33322 mbs)

mm of Hg	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
708	43.9	44.1	44.2	44.3	44.5	44.6	44.7	44.9	45.0	45.1
709	45.3	45.4	45.5	45.7	45.8	45.9	46.1	46.2	46.3	46.5
710	46.6	46.7	46.9	47.0	47.1	47.3	47.4	47.5	47.7	47.8
711	47.9	48.1	48.2	48.3	48.5	48.6	48.7	48.9	49.0	49.1
712	49.3	49.4	49.5	49.7	49.8	49.9	50.1	50.2	50.3	50.5
713	50.6	50.7	50.9	51.0	51.1	51.3	51.4	51.5	51.7	51.8
714	51.9	52.1	52.2	52.3	52.5	52.6	52.7	52.9	53.0	53.1
715	53.3	53.4	53.5	53.7	53.8	53.9	54.1	54.2	54.3	54.5
716	54.6	54.7	54.9	55.0	55.1	55.3	55.4	55.5	55.7	55.8
717	55.9	56.1	56.2	56.3	56.5	56.6	56.7	56.9	57.0	57.1
718	57.3	57.4	57.5	57.7	57.8	57.9	58.1	58.2	58.3	58.5
719	58.6	58.7	58.9	59.0	59.1	59.3	59.4	59.5	59.7	59.8
720	59.9	60.1	60.2	60.3	60.5	60.6	60.7	60.9	61.0	61.1
721	61.3	61.4	61.5	61.7	61.8	61.9	62.1	62.2	62.3	62.5
722	62.6	62.7	62.9	63.0	63.1	63.3	63.4	63.5	63.7	63.8
723	63.9	64.1	64.2	64.3	64.5	64.6	64.7	64.9	65.0	65.1
724	65.3	65.4	65.5	65.7	65.8	65.9	66.1	66.2	66.3	66.5
725	66.6	66.7	66.9	67.0	67.1	67.3	67.4	67.5	67.7	67.8
726	67.9	68.1	68.2	68.3	68.5	68.6	68.7	68.9	69.0	69.1
727	69.3	69.4	69.5	69.7	69.8	69.9	70.1	70.2	70.3	70.5
728	70.6	70.7	70.9	71.0	71.1	71.3	71.4	71.5	71.7	71.8
729	71.9	72.1	72.2	72.3	72.5	72.6	72.7	72.9	73.0	73.1
730	73.3	73.4	73.5	73.7	73.8	73.9	74.1	74.2	74.3	74.5
731	74.6	74.7	74.9	75.0	75.1	75.3	75.4	75.5	75.7	75.8
732	75.9	76.1	76.2	76.3	76.5	76.6	76.7	76.9	77.0	77.1
733	77.3	77.4	77.5	77.7	77.8	77.9	78.1	78.2	78.3	78.5
734	78.6	78.7	78.9	79.0	79.1	79.3	79.4	79.5	79.7	79.8
735	79.9	80.1	80.2	80.3	80.5	80.6	80.7	80.9	81.0	81.1

*The hundreds digit is not recorded. The true range of this part of Table 20 is 943.9 mbs - 981.1 mbs.

TABLE 19 (Cont'd)

Atmospheric Pressure

Conversion from millimeters of mercury to millibars* (Cont'd)
(1 mm of Hg = 1.33322 mbs)

mm of Hg	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
736	81.3	81.4	81.5	81.7	81.8	81.9	82.1	82.2	82.3	82.5
737	82.6	82.7	82.9	83.0	83.1	83.3	83.4	83.5	83.7	83.8
738	83.9	84.1	84.2	84.3	84.5	84.6	84.7	84.9	85.0	85.1
739	85.3	85.4	85.5	85.7	85.8	85.9	86.1	86.2	86.3	86.5
740	86.6	86.7	86.9	87.0	87.1	87.3	87.4	87.5	87.7	87.8
741	87.9	88.1	88.2	88.3	88.5	88.6	88.7	88.9	89.0	89.1
742	89.3	89.4	89.5	89.7	89.8	89.9	90.1	90.2	90.3	90.5
743	90.6	90.7	90.9	91.0	91.1	91.3	91.4	91.5	91.7	91.8
744	91.9	92.1	92.2	92.3	92.5	92.6	92.7	92.9	93.0	93.1
745	93.3	93.4	93.5	93.7	93.8	93.9	94.1	94.2	94.3	94.5
746	94.6	94.7	94.9	95.0	95.1	95.3	95.4	95.5	95.7	95.8
747	95.9	96.1	96.2	96.3	96.5	96.6	96.7	96.9	97.0	97.1
748	97.3	97.4	97.5	97.7	97.8	97.9	98.1	98.2	98.3	98.5
749	98.6	98.7	98.9	99.0	99.1	99.3	99.4	99.5	99.7	99.8
750	99.9	00.1	00.2	00.3	00.5	00.6	00.7	00.9	01.0	01.1
751	01.3	01.4	01.5	01.7	01.8	01.9	02.1	02.2	02.3	02.5
752	02.6	02.7	02.9	03.0	03.1	03.3	03.4	03.5	03.7	03.8
753	03.9	04.1	04.2	04.3	04.5	04.6	04.7	04.9	05.0	05.1
754	05.3	05.4	05.5	05.7	05.8	05.9	06.1	06.2	06.3	06.5
755	06.6	06.7	06.9	07.0	07.1	07.3	07.4	07.5	07.7	07.8
756	07.9	08.1	08.2	08.3	08.5	08.6	08.7	08.9	09.0	09.1
757	09.3	09.4	09.5	09.7	09.8	09.9	10.1	10.2	10.3	10.5
758	10.6	10.7	10.9	11.0	11.1	11.3	11.4	11.5	11.7	11.8
759	11.9	12.1	12.2	12.3	12.5	12.6	12.7	12.9	13.0	13.1
760	13.3	13.4	13.5	13.7	13.8	13.9	14.1	14.2	14.3	14.5
761	14.6	14.7	14.9	15.0	15.1	15.3	15.4	15.5	15.7	15.8
762	15.9	16.1	16.2	16.3	16.4	16.6	16.7	16.8	17.0	17.1
763	17.2	17.4	17.5	17.6	17.8	17.9	18.0	18.2	18.3	18.4
764	18.6	18.7	18.8	19.0	19.1	19.2	19.4	19.5	19.6	19.8
765	19.9	20.0	20.2	20.3	20.4	20.6	20.7	20.8	21.0	21.1

*The hundreds and thousands digits are not recorded. The true range of this part of Table 20 is 981.3 mbs - 1021.1 mbs.

TABLE 19 (Cont'd)

Atmospheric Pressure

Conversion from millimeters of mercury to millibars* (Cont'd)
(1 mm of Hg = 1.33322 mbs)

mm of Hg	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
766	21.2	21.4	21.5	21.6	21.8	21.9	22.0	22.2	22.3	22.4
767	22.6	22.7	22.8	23.0	23.1	23.2	23.4	23.5	23.6	23.8
768	23.9	24.0	24.2	24.3	24.4	24.6	24.7	24.8	25.0	25.1
769	25.2	25.4	25.5	25.6	25.8	25.9	26.0	26.2	26.3	26.4
770	26.6	26.7	26.8	27.0	27.1	27.2	27.4	27.5	27.6	27.8
771	27.9	28.0	28.2	28.3	28.4	28.6	28.7	28.8	29.0	29.1
772	29.2	29.4	29.5	29.6	29.8	29.9	30.0	30.2	30.3	30.4
773	30.6	30.7	30.8	31.0	31.1	31.2	31.4	31.5	31.6	31.8
774	31.9	32.0	32.2	32.3	32.4	32.6	32.7	32.8	33.0	33.1
775	33.2	33.4	33.5	33.6	33.8	33.9	34.0	34.2	34.3	34.4
776	34.6	34.7	34.8	35.0	35.1	35.2	35.4	35.5	35.6	35.8
777	35.9	36.0	36.2	36.3	36.4	36.6	36.7	36.8	37.0	37.1
778	37.2	37.4	37.5	37.6	37.8	37.9	38.0	38.2	38.3	38.4
779	38.6	38.7	38.8	39.0	39.1	39.2	39.4	39.5	39.6	39.8
780	39.9	40.0	40.2	40.3	40.4	40.6	40.7	40.8	41.0	41.1
781	41.2	41.4	41.5	41.6	41.8	41.9	42.0	42.2	42.3	42.4
782	42.6	42.7	42.8	43.0	43.1	43.2	43.4	43.5	43.6	43.8
783	43.9	44.0	44.2	44.3	44.4	44.6	44.7	44.8	45.0	45.1
784	45.2	45.4	45.5	45.6	45.8	45.9	46.0	46.2	46.3	46.4
785	46.6	46.7	46.8	47.0	47.1	47.2	47.4	47.5	47.6	47.8
786	47.9	48.0	48.2	48.3	48.4	48.6	48.7	48.8	49.0	49.1
787	49.2	49.4	49.5	49.6	49.8	49.9	50.0	50.2	50.3	50.4

*The hundreds and thousands digits are not recorded. The true range of this part of Table 20 is 1021.2 mbs. - 1050.4 mbs.

TABLE 20

Temperature

Conversion from Fahrenheit to Centigrade

°F	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
130	54.4	54.5	54.6	54.6	54.7	54.7	54.8	54.8	54.9	54.9
129	53.9	53.9	54.0	54.1	54.1	54.2	54.2	54.3	54.3	54.4
128	53.3	53.4	53.5	53.6	53.6	53.6	53.7	53.7	53.8	53.8
127	52.8	52.8	52.9	52.9	53.0	53.1	53.1	53.2	53.2	53.3
126	52.2	52.3	52.3	52.4	52.4	52.5	52.6	52.6	52.7	52.7
125	51.7	51.7	51.8	51.8	51.9	51.9	52.0	52.1	52.1	52.2
124	51.1	51.2	51.2	51.3	51.3	51.4	51.4	51.5	51.6	51.6
123	50.6	50.6	50.7	50.7	50.8	50.8	50.9	50.9	51.0	51.1
122	50.0	50.1	50.1	50.2	50.2	50.3	50.3	50.4	50.4	50.5
121	49.4	49.5	49.6	49.6	49.7	49.7	49.8	49.8	49.9	49.9
120	48.9	48.9	49.0	49.1	49.1	49.2	49.2	49.3	49.3	49.4
119	48.3	48.4	48.4	48.5	48.6	48.6	48.7	48.7	48.8	48.8
118	47.8	47.8	47.9	47.9	48.0	48.1	48.1	48.2	48.2	48.3
117	47.2	47.3	47.3	47.4	47.4	47.5	47.6	47.6	47.7	47.7
116	46.7	46.7	46.8	46.8	46.9	46.9	47.0	47.1	47.1	47.2
115	46.1	46.2	46.2	46.3	46.3	46.4	46.4	46.5	46.6	46.6
114	45.6	45.6	45.7	45.7	45.8	45.8	45.9	45.9	46.0	46.1
113	45.0	45.1	45.1	45.2	45.2	45.3	45.3	45.4	45.4	45.5
112	44.4	44.5	44.6	44.7	44.7	44.7	44.8	44.8	44.9	44.9
111	43.9	43.9	44.0	44.1	44.1	44.2	44.2	44.3	44.3	44.4
110	43.3	43.4	43.4	43.5	43.6	43.6	43.7	43.7	43.8	43.8
109	42.8	42.8	42.9	43.0	43.0	43.1	43.1	43.2	43.2	43.3
108	42.2	42.3	42.3	42.4	42.4	42.5	42.6	42.6	42.7	42.7
107	41.7	41.7	41.8	41.8	41.9	41.9	42.0	42.1	42.1	42.2
106	41.1	41.2	41.2	41.3	41.3	41.4	41.4	41.5	41.6	41.6
105	40.6	40.6	40.7	40.7	40.8	40.8	40.9	40.9	41.0	41.1
104	40.0	40.1	40.1	40.2	40.2	40.3	40.3	40.4	40.4	40.5

TABLE 20 (Cont'd)

Temperature

Conversion from Fahrenheit to Centigrade

°F	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
103	39.4	39.5	39.6	39.6	39.7	39.7	39.8	39.8	39.9	39.9
102	38.9	38.9	39.0	39.1	39.1	39.2	39.2	39.3	39.3	39.4
101	38.3	38.4	38.4	38.5	38.6	38.6	38.7	38.7	38.8	38.8
100	37.8	37.8	37.9	37.9	38.0	38.1	38.1	38.2	38.2	38.3
99	37.2	37.3	37.3	37.4	37.4	37.5	37.6	37.6	37.7	37.7
98	36.7	36.7	36.8	36.8	36.9	36.9	37.0	37.1	37.1	37.2
97	36.1	36.2	36.2	36.2	36.3	36.4	36.4	36.5	36.6	36.6
96	35.6	35.6	35.7	35.7	35.8	35.8	35.9	35.9	36.0	36.1
95	35.0	35.1	35.1	35.2	35.2	35.3	35.3	35.4	35.4	35.5
94	34.4	34.5	34.6	34.6	34.7	34.7	34.8	34.8	34.9	34.9
93	33.9	33.9	34.0	34.1	34.1	34.2	34.2	34.3	34.3	34.4
92	33.3	33.4	33.4	33.5	33.6	33.6	33.7	33.7	33.8	33.8
91	32.8	32.8	32.9	32.9	33.0	33.1	33.1	33.2	33.2	33.3
90	32.2	32.3	32.3	32.4	32.4	32.5	32.6	32.6	32.7	32.7
89	31.7	31.7	31.8	31.8	31.9	31.9	32.0	32.1	32.1	32.2
88	31.1	31.2	31.2	31.3	31.3	31.4	31.4	31.5	31.6	31.6
87	30.6	30.6	30.7	30.7	30.8	30.8	30.9	30.9	31.0	31.1
86	30.0	30.1	30.1	30.2	30.2	30.3	30.3	30.4	30.4	30.5
85	29.4	29.5	29.6	29.6	29.7	29.7	29.8	29.8	29.9	29.9
84	28.9	28.9	29.0	29.1	29.1	29.2	29.2	29.3	29.3	29.3
83	28.3	28.4	28.4	28.5	28.6	28.6	28.7	28.7	28.8	28.8
82	27.8	27.8	27.9	28.9	28.0	28.1	28.1	28.2	28.2	28.3
81	27.2	27.3	27.3	27.4	27.4	27.5	27.6	27.6	27.7	27.7
80	26.7	26.7	26.8	26.8	26.9	26.9	27.0	27.1	27.1	27.2
79	26.1	26.2	26.2	26.3	26.3	26.4	26.4	26.5	26.6	26.6
78	25.6	25.6	25.7	25.7	25.8	25.8	25.9	25.9	26.0	26.1
77	25.0	25.1	25.1	25.2	25.2	25.3	25.3	25.4	25.4	25.5

TABLE 20 (Cont'd)

Temperature

Conversion from Fahrenheit to Centigrade

°F	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
76	24.4	24.5	24.6	24.6	24.7	24.7	24.8	24.8	24.9	24.9
75	23.9	23.9	24.0	24.1	24.1	24.2	24.2	24.3	24.3	24.4
74	23.3	23.4	23.4	23.5	23.6	23.6	23.7	23.7	23.8	23.8
73	22.8	22.8	22.9	22.9	23.0	23.1	23.1	23.2	23.2	23.3
72	22.2	22.3	22.3	22.4	22.4	22.5	22.6	22.6	22.7	22.7
71	21.7	21.7	21.8	21.8	21.9	21.9	22.0	22.1	22.1	22.2
70	21.1	21.2	21.2	21.3	21.3	21.4	21.4	21.5	21.6	21.6
69	20.6	20.6	20.7	20.7	20.8	20.8	20.9	20.9	21.0	21.1
68	20.0	20.1	20.1	20.2	20.2	20.3	20.3	20.4	20.4	20.5
67	19.4	19.5	19.6	19.6	19.7	19.7	19.8	19.8	19.9	19.9
66	18.9	18.9	19.0	19.1	19.1	19.2	19.2	19.3	19.3	19.4
65	18.3	18.4	18.4	18.5	18.6	18.6	18.7	18.7	18.8	18.8
64	17.8	17.8	17.9	17.9	18.0	18.1	18.1	18.2	18.2	18.3
63	17.2	17.3	17.3	17.4	17.4	17.5	17.6	17.6	17.7	17.7
62	16.7	16.7	16.8	16.8	16.9	16.9	17.0	17.1	17.1	17.2
61	16.1	16.2	16.2	16.3	16.3	16.4	16.4	16.5	16.6	16.6
60	15.6	15.6	15.7	15.7	15.8	15.8	15.9	15.9	16.0	16.1
59	15.0	15.1	15.1	15.2	15.2	15.3	15.3	15.4	15.4	15.5
58	14.4	14.5	14.6	14.6	14.7	14.7	14.8	14.8	14.9	14.9
57	13.9	13.9	14.0	14.1	14.1	14.2	14.2	14.3	14.3	14.4
56	13.3	13.4	13.4	13.5	13.6	13.6	13.7	13.7	13.8	13.8
55	12.8	12.8	12.9	12.9	13.0	13.1	13.1	13.2	13.2	13.3
54	12.2	12.3	12.3	12.4	12.4	12.5	12.6	12.6	12.7	12.7
53	11.7	11.7	11.8	11.8	11.9	11.9	12.0	12.1	12.1	12.2
52	11.1	11.2	11.2	11.3	11.3	11.4	11.4	11.5	11.6	11.6
51	10.6	10.6	10.7	10.7	10.8	10.8	10.9	10.9	11.0	11.1
50	10.0	10.1	10.1	10.2	10.2	10.3	10.3	10.4	10.4	10.5

TABLE 20 (Cont'd)

Temperature

Conversion from Fahrenheit to Centigrade

°F	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
49	09.4	09.5	09.6	09.6	09.7	09.7	09.8	09.8	09.9	09.9
48	08.9	08.9	09.0	09.1	09.1	09.2	09.2	09.3	09.3	09.4
47	08.3	08.4	08.4	08.5	08.6	08.6	08.7	08.7	08.8	08.8
46	07.8	07.8	07.9	07.9	08.0	08.1	08.1	08.2	08.2	08.3
45	07.2	07.3	07.3	07.4	07.4	07.5	07.6	07.6	07.7	07.7
44	06.7	06.7	06.8	06.8	06.9	06.9	07.0	07.1	07.1	07.2
43	06.1	06.2	06.2	06.3	06.3	06.4	06.4	06.5	06.6	06.6
42	05.6	05.6	05.7	05.7	05.8	05.8	05.9	05.9	06.0	06.1
41	05.0	05.1	05.1	05.2	05.2	05.3	05.3	05.4	05.4	05.5
40	04.4	04.5	04.6	04.6	04.7	04.7	04.8	04.8	04.9	04.9
39	03.9	03.9	04.0	04.1	04.1	04.2	04.2	04.3	04.3	04.4
38	03.3	03.4	03.4	03.5	03.6	03.6	03.7	03.7	03.8	03.8
37	02.8	02.8	02.9	02.9	03.0	03.1	03.1	03.2	03.2	03.3
36	02.2	02.3	02.3	02.4	02.4	02.5	02.6	02.6	02.7	02.7
35	01.7	01.7	01.8	01.8	01.9	01.9	02.0	02.1	02.1	02.2
34	01.1	01.2	01.2	01.3	01.3	01.4	01.4	01.5	01.6	01.6
33	00.6	00.6	00.7	00.7	00.8	00.8	00.9	00.9	01.0	01.1
32	00.0	00.1	00.1	00.2	00.2	00.3	00.3	00.4	00.4	00.5
31	-00.6	-00.5	-00.4	-00.4	-00.3	-00.3	-00.2	-00.2	-00.1	-00.1
30	-01.1	-01.1	-01.0	-00.9	-00.9	-00.8	-00.8	-00.7	-00.7	-00.6
29	-01.7	-01.6	-01.6	-01.5	-01.4	-01.4	-01.3	-01.3	-01.2	-01.2
28	-02.2	-02.2	-02.1	-02.1	-02.0	-01.9	-01.9	-01.8	-01.8	-01.7
27	-02.8	-02.7	-02.7	-02.6	-02.6	-02.5	-02.4	-02.4	-02.3	-02.3
26	-03.3	-03.3	-03.2	-03.2	-03.1	-03.1	-03.0	-02.9	-02.9	-02.8
25	-03.9	-03.8	-03.8	-03.7	-03.7	-03.6	-03.6	-03.5	-03.4	-03.4
24	-04.4	-04.4	-04.3	-04.3	-04.2	-04.2	-04.1	-04.1	-04.0	-03.9
23	-05.0	-04.9	-04.9	-04.8	-04.8	-04.7	-04.7	-04.6	-04.6	-04.5

TABLE 20 (Cont'd)

Temperature

Conversion from Fahrenheit to Centigrade

°F	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
22	-05.6	-05.5	-05.4	-05.4	-05.3	-05.3	-05.2	-05.2	-05.1	-05.1
21	-06.1	-06.1	-06.0	-05.9	-05.9	-05.9	-05.8	-05.7	-05.7	-05.6
20	-06.7	-06.6	-06.6	-06.5	-06.4	-06.4	-06.3	-06.3	-06.2	-06.2
19	-07.2	-08.2	-07.1	-07.1	-07.0	-06.9	-06.9	-06.8	-06.8	-06.7
18	-07.8	-07.7	-07.7	-07.6	-07.6	-07.5	-07.4	-07.4	-07.3	-07.3
17	-08.3	-08.3	-08.2	-08.2	-08.1	-08.1	-08.0	-07.9	-07.9	-07.8
16	-08.9	-08.8	-08.8	-08.7	-08.7	-08.6	-08.6	-08.5	-08.4	-08.4
15	-09.4	-09.4	-09.3	-09.3	-09.2	-09.2	-09.1	-09.1	-09.0	-08.9
14	-10.0	-09.9	-09.9	-09.8	-09.8	-09.7	-09.7	-09.6	-09.6	-09.5
13	-10.6	-10.5	-10.4	-10.4	-10.3	-10.3	-10.2	-10.2	-10.1	-10.1
12	-11.1	-11.1	-11.0	-10.9	-10.9	-10.8	-10.8	-10.7	-10.7	-10.6
11	-11.7	-11.6	-11.6	-11.5	-11.4	-11.4	-11.3	-11.3	-11.2	-11.2
10	-12.2	-12.2	-12.1	-12.1	-12.0	-11.9	-11.9	-11.8	-11.8	-11.7
9	-12.8	-12.7	-12.7	-12.6	-12.6	-12.5	-12.4	-12.4	-12.3	-12.3
8	-13.3	-13.3	-13.2	-13.2	-13.1	-13.1	-13.0	-12.9	-12.9	-12.8
7	-13.9	-13.8	-13.8	-13.7	-13.7	-13.6	-13.6	-13.5	-13.4	-13.4
6	-14.4	-14.4	-14.3	-14.3	-14.2	-14.2	-14.1	-14.1	-14.0	-13.9
5	-15.0	-14.9	-14.9	-14.8	-14.8	-14.7	-14.7	-14.6	-14.6	-14.5
4	-15.6	-15.5	-15.4	-15.4	-15.3	-15.3	-15.2	-15.2	-15.1	-15.1
3	-16.1	-16.1	-16.0	-15.9	-15.9	-15.8	-15.8	-15.7	-15.7	-15.6
2	-16.7	-16.6	-16.6	-16.5	-16.4	-16.4	-16.3	-16.3	-16.2	-16.2
1	-17.2	-17.2	-17.1	-17.1	-17.0	-16.9	-16.9	-16.8	-16.8	-16.7
0	-17.8	-17.7	-17.7	-17.6	-17.6	-17.5	-17.4	-17.4	-17.3	-17.3
-0	-17.8	-17.8	-17.9	-17.9	-18.0	-18.1	-18.1	-18.2	-18.2	-18.3
-1	-18.3	-18.4	-18.4	-18.5	-18.6	-18.6	-18.7	-18.7	-18.8	-18.8
-2	-18.9	-18.9	-19.0	-19.1	-19.1	-19.2	-19.2	-19.3	-19.3	-19.4
-3	-19.4	-19.5	-19.6	-19.6	-19.7	-19.7	-19.8	-19.8	-19.9	-19.9

TABLE 20 (Cont'd)

Temperature

Conversion from Fahrenheit to Centigrade

°F	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
-31	-35.0	-35.1	-35.1	-35.2	-35.2	-35.3	-35.3	-35.4	-35.4	-35.5
-32	-35.6	-35.6	-35.7	-35.7	-35.8	-35.8	-35.9	-35.9	-36.0	-36.1
-33	-36.1	-36.2	-36.2	-36.3	-36.3	-36.4	-36.4	-36.5	-36.6	-36.6
-34	-36.7	-36.7	-36.8	-36.8	-36.9	-36.9	-37.0	-37.1	-37.1	-37.2
-35	-37.2	-37.3	-37.3	-37.4	-37.4	-37.5	-37.6	-37.6	-37.7	-37.7
-36	-37.8	-37.8	-37.9	-37.9	-38.0	-38.1	-38.1	-38.2	-38.2	-38.3
-37	-38.3	-38.4	-38.4	-38.4	-38.5	-38.6	-38.6	-38.7	-38.7	-38.8
-38	-38.9	-38.9	-39.0	-39.1	-39.1	-39.2	-39.2	-39.3	-39.3	-39.4
-39	-39.4	-39.5	-39.6	-39.6	-39.7	-39.7	-39.8	-39.8	-39.9	-39.9
-40	-40.0	-40.1	-40.1	-40.2	-40.2	-40.3	-40.3	-40.4	-40.4	-40.5
-41	-40.6	-40.6	-40.7	-40.7	-40.8	-40.8	-40.9	-40.9	-41.0	-41.1
-42	-41.1	-41.2	-41.2	-41.3	-41.3	-41.4	-41.4	-41.5	-41.6	-41.6
-43	-41.7	-41.7	-41.8	-41.8	-41.9	-41.9	-42.0	-42.1	-42.1	-42.2
-44	-42.2	-42.3	-42.3	-42.4	-42.4	-42.6	-42.6	-42.6	-42.7	-42.7
-45	-42.8	-42.8	-42.9	-42.9	-43.0	-43.1	-43.1	-43.2	-43.2	-43.3
-46	-43.3	-43.4	-43.4	-43.5	-43.6	-43.6	-43.7	-43.7	-43.8	-43.8
-47	-43.9	-43.9	-44.0	-44.1	-44.1	-44.2	-44.2	-44.3	-44.3	-44.4
-48	-44.4	-44.5	-44.6	-44.6	-44.7	-44.7	-44.8	-44.8	-44.9	-44.9
-49	-45.0	-45.1	-45.1	-45.2	-45.2	-45.3	-45.3	-45.4	-45.4	-45.5
-50	-45.6	-45.6	-45.7	-45.7	-45.8	-45.8	-45.9	-45.9	-46.0	-46.1
-51	-46.1	-46.2	-46.2	-46.3	-46.3	-46.4	-46.4	-46.5	-46.5	-46.6
-52	-46.7	-46.7	-46.8	-46.8	-46.9	-46.9	-47.0	-47.1	-47.1	-47.2
-55	-47.2	-47.3	-47.3	-47.4	-47.4	-47.5	-47.6	-47.6	-47.7	-47.7
-54	-47.8	-47.8	-47.9	-47.9	-48.0	-48.1	-48.1	-48.2	-48.2	-48.3
-55	-48.3	-48.4	-48.4	-48.5	-48.6	-48.6	-48.7	-48.7	-48.8	-48.8
-56	-48.9	-48.9	-49.0	-49.1	-49.1	-49.2	-49.2	-49.3	-49.3	-49.4
-57	-49.4	-49.5	-49.6	-49.6	-49.7	-49.7	-49.8	-49.8	-49.9	-49.9

TABLE 20 (Cont'd)

Temperature

Conversion from Fahrenheit to Centigrade

°F	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
-4	-20.0	-20.1	-20.1	-20.2	-20.2	-20.3	-20.3	-20.4	-20.4	-20.5
-5	-20.6	-20.6	-20.7	-20.7	-20.3	-20.8	-20.9	-20.9	-21.0	-21.1
-6	-21.1	-21.2	-21.2	-21.3	-21.3	-21.4	-21.4	-21.5	-21.6	-21.6
-7	-21.7	-21.7	-21.8	-21.8	-21.9	-21.9	-22.0	-22.1	-22.1	-22.2
-8	-22.2	-22.3	-22.3	-22.4	-22.4	-22.5	-22.6	-22.6	-22.7	-22.7
-9	-22.8	-22.8	-22.9	-22.9	-23.0	-23.1	-23.1	-23.2	-23.2	-23.3
-10	-23.3	-23.4	-23.4	-23.5	-23.6	-23.6	-23.7	-23.7	-23.8	-23.8
-11	-23.9	-23.9	-24.0	-24.1	-24.1	-24.2	-24.2	-24.3	-24.3	-24.4
-12	-24.4	-24.5	-24.6	-24.6	-24.7	-24.7	-24.8	-24.8	-24.9	-24.9
-13	-25.0	-25.1	-25.1	-25.2	-25.2	-25.3	-25.3	-25.4	-25.4	-25.5
-14	-25.6	-25.6	-25.7	-25.7	-25.8	-25.8	-25.9	-26.9	-26.0	-26.1
-15	-26.1	-26.2	-26.2	-26.3	-26.3	-26.4	-26.4	-26.5	-26.6	-26.6
-16	-26.7	-26.7	-26.8	-26.8	-26.9	-26.9	-27.0	-27.1	-27.1	-27.2
-17	-27.2	-27.3	-27.3	-27.4	-27.4	-27.5	-27.6	-27.6	-27.7	-27.7
-18	-27.8	-27.8	-27.9	-28.9	-28.0	-28.1	-28.1	-28.2	-28.2	-28.3
-19	-28.3	-28.4	-28.4	-28.5	-28.6	-28.6	-28.7	-28.7	-28.8	-28.8
-20	-28.9	-28.9	-29.0	-29.1	-29.1	-29.2	-29.2	-29.3	-29.3	-29.4
-21	-29.4	-29.5	-29.6	-29.6	-29.7	-29.7	-29.8	-29.8	-29.9	-29.9
-22	-30.0	-30.1	-30.1	-30.2	-30.2	-30.3	-30.3	-30.4	-30.4	-30.5
-23	-30.6	-30.6	-30.7	-30.7	-30.8	-30.8	-30.9	-30.9	-31.0	-31.1
-24	-31.1	-31.2	-31.2	-31.3	-31.3	-31.4	-31.4	-31.6	-31.6	-31.6
-25	-31.7	-31.7	-31.8	-31.8	-31.9	-31.9	-32.0	-32.1	-32.1	-32.2
-26	-32.2	-32.3	-32.3	-32.4	-32.4	-32.5	-32.6	-32.6	-32.7	-32.7
-27	-32.8	-32.8	-32.9	-32.9	-33.0	-33.1	-33.1	-33.2	-33.2	-33.3
-28	-33.3	-33.4	-33.4	-33.5	-33.6	-33.6	-33.7	-33.7	-33.8	-33.8
-29	-33.9	-33.9	-34.0	-34.1	-34.1	-34.2	-34.2	-34.3	-34.3	-34.4
-30	-34.4	-34.5	-34.6	-34.6	-34.7	-34.7	-34.8	-34.8	-34.9	-34.9

TABLE 20 (Cont'd)

Temperature

Conversion from Fahrenheit to Centigrade

°F	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
-58	-50.0	-50.1	-50.1	-50.2	-50.2	-50.3	-50.3	-50.4	-50.4	-50.5
-59	-50.6	-50.6	-50.7	-50.7	-50.8	-50.8	-50.9	-50.9	-51.0	-51.1
-60	-51.1	-51.2	-51.2	-51.3	-51.3	-51.4	-51.4	-51.5	-51.6	-51.6
-61	-51.7	-51.7	-51.8	-51.8	-51.9	-51.9	-52.0	-52.1	-52.1	-52.2
-62	-52.2	-52.3	-52.3	-52.4	-52.4	-52.5	-52.6	-52.6	-52.7	-52.7
-63	-52.8	-52.8	-52.9	-52.9	-53.0	-53.1	-53.1	-53.2	-53.2	-53.3
-64	-53.3	-53.4	-53.4	-53.5	-53.6	-53.6	-53.7	-53.7	-53.8	-53.8
-65	-53.9	-53.9	-54.0	-54.1	-54.1	-54.2	-54.2	-54.3	-54.3	-54.4
-66	-54.4	-54.6	-54.6	-54.6	-54.7	-54.7	-54.8	-54.8	-54.9	-54.9
-67	-55.0	-55.1	-55.1	-55.2	-55.2	-55.3	-55.3	-55.4	-55.4	-55.5
-68	-55.6	-55.6	-55.7	-55.7	-55.8	-55.8	-55.9	-55.9	-56.0	-56.1
-69	-56.1	-56.2	-56.2	-56.3	-56.3	-56.4	-56.4	-56.5	-56.6	-56.6
-70	-56.7	-56.7	-56.8	-56.8	-56.9	-56.9	-57.0	-57.1	-57.1	-57.2

TABLE 21

Present Weather

WMO Code 4501 for recording present weather

Code
figure

- | | |
|---|---------------------------------------|
| 0 | Clear (no cloud at any level) |
| 1 | Partly cloudy (scattered or broken) |
| 2 | Continuous layer(s) of cloud(s) |
| 3 | Sandstorm, duststorm, or blowing snow |
| 4 | Fog, thick dust or haze |
| 5 | Drizzle |
| 6 | Rain |
| 7 | Snow, or rain and snow mixed |
| 8 | Shower(s) |
| 9 | Thunderstorm(s) |

TABLE 22

Present Weather

Conversion from Beaufort weather notation to WMO Code 4501

<u>Abbreviation</u>	<u>Description</u>	<u>Code</u>
b.	Blue sky whether with clear or hazy atmosphere, or sky not more than one-quarter clouded.	0
bc.	Sky between one-quarter and three-quarters clouded.	1
c.	Mainly cloudy (not less than three-quarters covered.)	1
d.	Drizzle or fine rain.	5
e.	Wet air without rain falling.	4
f.	Fog.	4
fe.	Wet fog.	4
g.	Gloomy.	2
h.	Hail.	9
kq.	Line squall.	9
l.	Lightning	9
m.	Mist.	4
o.	Overcast sky (i.e., the whole sky covered with unbroken cloud).	2
p.	Passing showers.	8
q.	Squalls.	9
r.	Rain.	6
rs.	Sleet (i.e., rain and snow together).	7
s.	Snow.	7
t.	Thunder.	9
tl.	Thunderstorm.	9
u.	Ugly, threatening sky.	2
v.	Unusual visibility.	0
z.	Dust haze; the turbid atmosphere of dry weather.	4

TABLE 23

Present Weather

Conversion from 1936 International Meteorological Organization Code to the

WMO Code 4501

<u>Code Underlined</u>		WMO Code 4501 (equivalent)
ABBREVIATED DESCRIPTION OF SKY AND SPECIAL PHENOMENA		
00	Cloudless	0
01	Partly cloudy.	1
02	Cloudy.	1
03	Overcast.	2
04	Low fog, on ground or over sea.	4
05	Haze (but visibility greater than 2,000 m., 2,200 yds).	4
06	Dust devils seen.	4
07	Distant lightning.	9
08	Light fog or mist (visibility between 1,000 and 2,000 m., 1,100 and 2,200 yds).	4
09	Fog at a distance, but not at the ship.	4
10	Precipitation within sight.	6
11	Thunder, without precipitation at the ship.	9
12	Dust storm within sight, but not at the ship.	3
13	Ugly, threatening sky.	9
14	Squally weather.	9
15	Heavy squalls. }	9
16	Waterspouts seen. } in last 3 hours	9

PRECIPITATION IN LAST HOUR BUT NOT AT TIME OF OBSERVATION

20	Precipitation (rain, drizzle, hail, snow, or sleet)	-
21	Drizzle	5
22	Rain	6
23	Snow	7
24	Rain and snow or sleet	7
25	Rain shower (s).	8
26	Snow shower (s).	7
27	Hail or rain and hail shower (s).	9
28	Slight thunderstorm.	9
29	Heavy thunderstorm.	9

TABLE 23 (Cont'd)

Conversion from 1936 International Meteorological Organization Code to the
WMO Code 4501

DUST STORMS AND STORMS OF DRIFTING SNOW		WMO	
(Visibility less than 1,000 m., 1,100 yards)		Code	
		4501	
		(equivalent)	
30	Dust or sand storm.	3	
31	Dust or sand storm, has decreased.	3	
32	Dust or sand storm, no appreciable change.	3	
33	Dust or sand storm, has increased.	3	
34	Line of dust storms.	-	
35	Storm of drifting snow.	3	
36	Slight storm of drifting snow	} generally low.	3
37	Heavy storm of drifting snow		3
38	Slight storm of drifting snow	} generally high.	3
39	Heavy storm of drifting snow		3

FOG

(Visibility less than 1,000 m., 1,100 yards)

40	Fog.		4
41	Moderate fog in last hour	} but not at time of observation.	4
42	Thick fog in last hour		4
43	Fog, sky discernible	} has become thinner during last hour.	4
44	Fog, sky not discernible		4
45	Fog, sky discernible	} no appreciable change during last hour	4
46	Fog, sky not discernible		4
47	Fog, sky discernible	} has begun or become thicker during	4
48	Fog, sky not discernible		4
49	Fog in patches.	last hour	4

DRIZZLE

(Precipitation consisting of numerous minute drops)

50	Drizzle		5	
51	Intermittent	{	slight drizzle.	5
52	Continuous			5
53	Intermittent	{	moderate drizzle.	5
54	Continuous			5
55	Intermittent	{	thick drizzle.	5
56	Continuous			5
57	Drizzle and fog.		-	-
58	Slight or moderate	{	drizzle and rain.	5
59	Thick			5

TABLE 23 (Cont'd)

Conversion from 1936 International Meteorological Organization Code to the

WMO Code 4501

		RAIN	WMO Code 4501 (equivalent)
60	Rain.		6
61	Intermittent	} slight rain.	6
62	Continuous		6
63	Intermittent	} moderate rain.	6
64	Continuous		6
65	Intermittent	} heavy rain.	6
66	Continuous		6
67	Rain and fog.		-
68	Slight or moderate	} rain and snow, mixed.	7
69	Heavy		7
		SNOW	
70	Snow or sleet		7
71	Intermittent	} slight snow in flakes	7
72	Continuous		7
73	Intermittent	} moderate snow in flakes	7
74	Continuous		7
75	Intermittent	} heavy snow in flakes	7
76	Continuous		7
77	Snow and fog.		-
78	Granular snow (frozen drizzle).		7
79	Ice crystals;		7
		SHOWERS (S)	
80	Shower (s)		8
81	Shower (s) of slight or moderate	} rain	8
82	Shower (s) of heavy		8
83	Shower (s) of slight or moderate	} snow	7
84	Shower (s) of heavy		7
85	Shower (s) of slight or moderate	} rain and snow.	7
86	Shower (s) of heavy		7
87	Shower (s) of granular snow		7
88	Shower (s) of slight or moderate	} hail, or rain and hail.	7
89	Shower (s) of heavy		7

TABLE 23 (Cont'd)

Conversion from 1936 International Meteorological Organization Code to the

WMO Code 4501

THUNDERSTORM

WMO
Code
4501
(equivalent)

90	Thunderstorm		9
91	Rain at time	} thunderstorm during last hour, but not at time of observation.	9
92	Snow, or sleet at time		9
93	Thunderstorm, slight without hail or soft hail, but with rain (or snow)		9
94	Thunderstorm slight with soft hail	} at time of observation.	9
95	Thunderstorm moderate without hail, but with rain (or snow)		9
96	Thunderstorm moderate with soft hail		9
97	Thunderstorm heavy without hail, but with rain (or snow)		9
98	Thunderstorm combined with dust storm		9
99	Thunderstorm heavy with hail		9

TABLE 24

Present Weather

WMO Code 4677 for recording present weather

Code figure		ww	
No meteors except photometeors	{	00	Cloud development not observed or not observable
		01	Clouds generally dissolving or becoming less developed
		02	State of sky on the whole unchanged
		03	Clouds generally forming or developing
Haze, dust, sand or smoke	{	characteristic change of the state of sky during the past hour	
		04	Visibility reduced by smoke, e. g. veldt or forest fires, industrial smoke or volcanic ashes
		05	Haze
		06	Widespread dust in suspension in the air, not raised by wind at or near the station at the time of observation
		07	Dust or sand raised by wind at or near the station at the time of observation, but no well developed dust whirl(s) or sand whirl(s), and no dust-storm or sandstorm seen
		08	Well developed dust whirl(s) or sand whirl(s) seen at or near the station during the preceding hour or at the time of observation, but no duststorm or sandstorm
		09	Duststorm or sandstorm within sight at the time of observation, or at the station during the preceding hour
		10	Mist
		11	{ shallow fog or ice fog at the station, whether on land or sea, not deeper than about 2 metres on land or 10 metres at sea
		12	
		13	Lightning visible, no thunder heard
		14	Precipitation within sight, not reaching the ground or the surface of the sea
		15	Precipitation within sight, reaching the ground or the surface of the sea, but distant (i. e. estimated to be more than 5 km) from the station
		16	Precipitation within sight, reaching the ground or the surface of the sea, near to, but not at the station
		17	Thunderstorm, but no precipitation at the time of observation
		18	Squalls
		19	Funnel cloud(s) **
		at or within sight of the station during the preceding hour or at the time of observation	

* The expression "at the station" refers to a land station or a ship.

** Tornado cloud or waterspout.

TABLE 24 (Cont'd)

ww = 20 – 29 Precipitation, fog, ice fog or thunderstorm at the station during the preceding hour but not at the time of observation

Code figure

ww

20	Drizzle (not freezing) or snow grains	}	not falling as shower(s)
21	Rain (not freezing)		
22	Snow		
23	Rain and snow or ice pellets, type (a)		
24	Freezing drizzle or freezing rain	}	
25	Shower(s) of rain		
26	Shower(s) of snow, or of rain and snow		
27	Shower(s) of hail*, or of rain and hail*		
28	Fog or ice fog		
29	Thunderstorm (with or without precipitation)		

ww = 30 – 39 Duststorm, sandstorm, drifting or blowing snow

ww

30	Slight or moderate dust-storm or sandstorm	}	- has decreased during the preceding hour
31			- no appreciable change during the preceding hour
32			- has begun or has increased during the preceding hour
33	Severe duststorm or sandstorm	}	- has decreased during the preceding hour
34			- no appreciable change during the preceding hour
35			- has begun or has increased during the preceding hour
36	Slight or moderate blowing snow	}	generally low (below eye level)
37	Heavy drifting snow		
38	Slight or moderate blowing snow	}	generally high (above eye level)
39	Heavy blowing snow		

ww = 40 – 49 Fog or ice fog at the time of observation

ww

40	Fog or ice fog at a distance at the time of observation, but not at the station during the preceding hour, the fog or ice fog extending to a level above that of the observer		
41	Fog or ice fog in patches		
42	Fog or ice fog, sky visible	}	has become thinner during the preceding hour
43	Fog or ice fog, sky invisible		

* Hail, ice pellets, type (b), snow pellets. French : grêle, grésil ou neige roulée.

TABLE 24 (Cont'd)

Code figure

44	Fog or ice fog, sky visible	}	no appreciable change during the preceding hour
45	Fog or ice fog, sky invisible		
46	Fog or ice fog, sky visible	}	has begun or has become thicker during the preceding hour
47	Fog or ice fog, sky invisible		
48	Fog, depositing rime, sky visible		
49	Fog, depositing rime, sky invisible		

ww = 50 – 99 *Precipitation at the station at the time of observation*

ww = 50 – 59 Drizzle

ww

50	Drizzle, not freezing, intermittent	}	slight at time of observation
51	Drizzle, not freezing, continuous		
52	Drizzle, not freezing, intermittent	}	moderate at time of observation
53	Drizzle, not freezing, continuous		
54	Drizzle, not freezing, intermittent	}	heavy (dense) at time of observation
55	Drizzle, not freezing, continuous		
56	Drizzle, freezing, slight		
57	Drizzle, freezing, moderate or heavy (dense)		
58	Drizzle and rain, slight		
59	Drizzle and rain, moderate or heavy		

ww = 60 – 69 Rain

ww

60	Rain, not freezing, intermittent	}	slight at time of observation
61	Rain, not freezing, continuous		
62	Rain, not freezing, intermittent	}	moderate at time of observation
63	Rain, not freezing, continuous		
64	Rain, not freezing, intermittent	}	heavy at time of observation
65	Rain, not freezing, continuous		
66	Rain, freezing, slight		
67	Rain, freezing, moderate or heavy		
68	Rain or drizzle and snow, slight		
69	Rain or drizzle and snow, moderate or heavy		

ww = 70 – 79 Solid precipitation not in showers

ww

70	Intermittent fall of snow flakes	}	slight at time of observation
71	Continuous fall of snow flakes		
72	Intermittent fall of snow flakes	}	moderate at time of observation
73	Continuous fall of snow flakes		

TABLE 24 (Cont'd)

Code figure	
74	Intermittent fall of snow flakes
75	Continuous fall of snow flakes
76	Ice prisms (with or without fog)
77	Snow grains (with or without fog)
78	Isolated starlike snow crystals (with or without fog)
79	Ice pellets, type (a)

ww = 80 - 99	Showery precipitation, or precipitation with current or recent thunderstorm
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ww		
80	Rain shower(s), slight	
81	Rain shower(s), moderate or heavy	
82	Rain shower(s), violent	
83	Shower(s) of rain and snow mixed, slight	
84	Shower(s) of rain and snow mixed, moderate or heavy	
85	Snow shower(s), slight	
86	Snow shower(s), moderate or heavy	
87	Shower(s) of snow pellets or ice pellets, type (b), with or without rain or rain and snow mixed	} - slight
88		
89	Shower(s) of hail*, with or without rain or rain and snow mixed, not associated with thunder	} - slight
90		
91	Slight rain at time of observation	} thunderstorm during the preceding hour but not at time of observation
92	Moderate or heavy rain at time of observation	
93	Slight snow, or rain and snow mixed or hail** at time of observation	
94	Moderate or heavy snow, or rain and snow mixed or hail** at time of observation	} thunderstorm at time of observation
95	Thunderstorm, slight or moderate, without hail**, but with rain and/or snow at time of observation	
96	Thunderstorm, slight or moderate, with hail** at time of observation	
97	Thunderstorm, heavy, without hail**, but with rain and/or snow at time of observation	
98	Thunderstorm combined with dust-storm or sandstorm at time of observation	
99	Thunderstorm, heavy, with hail** at time of observation	

* French: grêle.

** Hail, ice pellets, type (b), snow pellets. French: grêle, grésil ou neige roulée.

TABLE 25

Cloud Type (Genus)

WMO Code 0500 for recording cloud type (genus)

Code

0	Cirrus	Ci
1	Cirrocumulus	Cc
2	Cirrostratus	Cs
3	Alto cumulus	Ac
4	Altostratus	As
5	Nimbostratus	Ns
6	Stratocumulus	Sc
7	Stratus	St
8	Cumulus.	Cu
9	Cumulonimbus.	Cb
x	Cloud not visible owing to darkness, fog, duststorm, sandstorm, or other analogous phenomena	

TABLE 26

Cloud Amount

WMO Code 2700 for recording cloud amount

Code

0	0	0
1	1 okta or less, but not zero	$\frac{1}{10}$ or less, but not zero
2	2 oktas	$\frac{2}{10} - \frac{3}{10}$
3	3 oktas	$\frac{4}{10}$
4	4 oktas	$\frac{5}{10}$
5	5 oktas	$\frac{6}{10}$
6	6 oktas	$\frac{7}{10} - \frac{8}{10}$
7	7 oktas or more, but not 8 oktas	$\frac{9}{10}$ or more, but not $\frac{10}{10}$
8	8 oktas	$\frac{10}{10}$
9	Sky obscured, or cloud amount cannot be estimated	

TABLE 27

Visibility

WMO Code 4300 for recording visibility at surface

Code

0	Less than 50 metres (less than 55 yards)
1	50-200 metres (approx. 55-220 yards)
2	200-500 metres (approx. 220-550 yards)
3	500-1,000 metres (approx. 550 yards-5/8 n.m.)
4	1- 2 km (approx. 5/8-1 n.m.)
5	2- 4 km (approx. 1- 2 n.m.)
6	4-10 km (approx. 2- 6 n.m.)
7	10-20 km (approx. 6-12 n.m.)
8	20-50 km (approx. 12-30 n.m.)
9	50 km or more (30 n.m. or more)

TABLE 28

PRECISION OF MEASUREMENT CODE

Columns 37 and 42 may be used for entry of a precision of measurement code. See table below. Provisions under which the originator may enter the precision of measurement code are as follows:

1. Temperature and/or salinity are reported to the hundredths place only.
2. A "cruise measurement error" has been computed and is entered in the general remarks space of the coding form. The "cruise measurement error" is defined as the standard deviation of the differences between all duplicate determinations or paired thermometer readings obtained for the cruise (or specific groups of stations of the cruise.) This parameter may also be given (for future inclusion on the cruise master card now being developed) even though no individual precision of measurement codes are given at individual observed levels.
3. The doubtful data entry (?) is given precedence over the precision code entry.
4. No precision of measurement entry should be coded at individual levels where the difference is equal to or less than the "cruise measurement error." For example, if the "cruise measurement error" for salinity is + 0.018 ‰, no precision code entry should be made for determination differences of 0.018 ‰ or less; in this example, the first permissible precision of measurement "entry" would be D.

<u>Difference of Paired Thermometers (°C.)</u>	<u>Difference of Dual Salinity Measurements (‰)</u>	<u>Code</u>
.01	.005	A
.02	.010	B
.03	.015	C
.04	.020	D
.05	.025	E
.06	.030	F
.07	.035	G
.08	.040	H
.09	.045	I
.10	.050	J
.11	.055	K
.12	.060	L
.13	.065	M
.14 or > .14	.070 or > .070	N

NOTE: Thousandth place should be truncated, not rounded (i.e., 0.010 through 0.019 = 0.01) before determining code.

TABLE 29

Salinity

Conversion from chlorinity to salinity ‰

Cl	S	Cl	S	Cl	S	Cl	S
0.01	0.05	0.40	0.75	0.80	1.47	1.20	2.20
.02	.07	.41	.77	.81	.49	.21	.21
.03	.08	.42	.79	.82	.51	.22	.23
.04	.10	.43	.81	.83	.53	.23	.25
.05	.12	.44	.82	.84	.55	.24	.27
.06	.14	.45	.84	.85	.56	.25	.29
.07	.16	.46	.86	.86	.58	.26	.30
.08	.17	.47	.88	.87	.60	.27	.32
.09	.19	.48	.90	.88	.62	.28	.34
		.49	.91	.89	.64	.29	.36
0.10	0.21						
.11	.23	0.50	0.93	0.90	1.65	1.30	2.38
.12	.25	.51	.95	.91	.67	.31	.39
.13	.26	.52	.97	.92	.69	.32	.41
.14	.28	.53	.99	.93	.71	.33	.43
.15	.30	.54	1.00	.94	.73	.34	.45
.16	.32	.55	1.02	.95	.74	.35	.47
.17	.34	.56	1.04	.96	.76	.36	.48
.18	.35	.57	1.06	.97	.78	.37	.50
.19	.37	.58	1.08	.98	.80	.38	.52
		.59	1.09	.99	.82	.39	.54
0.20	0.39						
.21	.41	0.60	1.11	1.00	1.84		
.22	.43	.61	1.13	.01	.85		
.23	.45	.62	1.15	.02	.87		
.24	.46	.63	1.17	.03	.89		
.25	.48	.64	1.19	.04	.91		
.26	.50	.65	1.20	.05	.93		
.27	.52	.66	1.22	.06	.94		
.28	.54	.67	1.24	.07	.96		
.29	.55	.68	1.26	.08	.98		
		.69	1.28	.09	2.00		
0.30	0.57						
.31	.59	0.70	1.29	1.10	2.02		
.32	.61	.71	1.31	.11	.03		
.33	.63	.72	1.33	.12	.05		
.34	.64	.73	1.35	.13	.07		
.35	.66	.74	1.37	.14	.09		
.36	.68	.75	1.38	.15	.11		
.37	.70	.76	1.40	.16	.12		
.38	.72	.77	1.42	.17	.14		
.39	.73	.78	1.44	.18	.16		
		.79	1.46	.19	.18		

TABLE 29 (Cont'd)

Salinity

Conversion from chlorinity to salinity (‰)

Cl	S	Cl	S	Cl	S	Cl	S
1.40	2.56	1.80	3.28	2.20	4.00	2.60	4.72
.41	.58	.81	.30	.21	.02	.61	.74
.42	.59	.82	.32	.22	.04	.62	.76
.43	.61	.83	.33	.23	.06	.63	.78
.44	.63	.84	.35	.24	.07	.64	.80
.45	.65	.85	.37	.25	.09	.65	.81
.46	.67	.86	.39	.26	.11	.66	.83
.47	.68	.87	.41	.27	.13	.67	.85
.48	.70	.88	.42	.28	.15	.68	.87
.49	.72	.89	.44	.29	.16	.69	.89
1.50	2.74	1.90	3.46	2.30	4.18	2.70	4.90
.51	.76	.91	.48	.31	.20	.71	.92
.52	.77	.92	.50	.32	.22	.72	.94
.53	.79	.93	.51	.33	.24	.73	.96
.54	.81	.94	.53	.34	.25	.74	.98
.55	.83	.95	.55	.35	.27	.75	.99
.56	.85	.96	.57	.36	.29	.76	5.01
.57	.86	.97	.59	.37	.31	.77	.03
.58	.88	.98	.60	.38	.33	.78	.05
.59	.90	.99	.62	.39	.34	.79	.07
1.60	2.92	2.00	3.64	2.40	4.36	2.80	5.08
.61	.94	.01	.66	.41	.38	.81	.10
.62	.95	.02	.68	.42	.40	.82	.12
.63	.97	.03	.69	.43	.42	.83	.14
.64	.99	.04	.71	.44	.43	.84	.16
.65	3.01	.05	.73	.45	.45	.85	.17
.66	.03	.06	.75	.46	.47	.86	.19
.67	.04	.07	.77	.47	.49	.87	.21
.68	.06	.08	.78	.48	.51	.88	.23
.69	.08	.09	.80	.49	.52	.89	.25
1.70	3.10	2.10	3.82	2.50	4.54	2.90	5.26
.71	.12	.11	.84	.51	.56	.91	.28
.72	.13	.12	.86	.52	.58	.92	.30
.73	.15	.13	.87	.53	.60	.93	.32
.74	.17	.14	.89	.54	.61	.94	.34
.75	.19	.15	.91	.55	.63	.95	.35
.76	.21	.16	.93	.56	.65	.96	.37
.77	.22	.17	.95	.57	.67	.97	.39
.78	.24	.18	.96	.58	.69	.98	.41
.79	.26	.19	.98	.59	.70	.99	.43

TABLE 29 (Cont'd)

Salinity

Conversion from chlorinity to salinity (°/oo)

C1	S	C1	S	C1	S	C1	S
3.00	5.45	3.40	6.17	3.80	6.89	4.20	7.61
.01	.46	.41	.19	.81	.91	.21	.63
.02	.48	.42	.20	.82	.93	.22	.65
.03	.50	.43	.22	.83	.94	.23	.67
.04	.52	.44	.24	.84	.96	.24	.68
.05	.54	.45	.26	.85	.98	.25	.70
.06	.55	.46	.28	.86	7.00	.26	.72
.07	.57	.47	.29	.87	.02	.27	.74
.08	.59	.48	.31	.88	.03	.28	.76
.09	.61	.49	.33	.89	.05	.29	.77
3.10	5.63	3.50	6.35	3.90	7.07	4.30	7.79
.11	.64	.51	.37	.91	.09	.31	.81
.12	.66	.52	.38	.92	.11	.32	.83
.13	.68	.53	.40	.93	.12	.33	.85
.14	.70	.54	.42	.94	.14	.34	.86
.15	.72	.55	.44	.95	.16	.35	.88
.16	.73	.56	.46	.96	.18	.36	.90
.17	.75	.57	.47	.97	.20	.37	.92
.18	.77	.58	.49	.98	.21	.38	.94
.19	.79	.59	.51	.99	.23	.39	.95
3.20	5.81	3.60	6.53	4.00	7.25	4.40	7.97
.21	.82	.61	.55	.01	.27	.41	.99
.22	.84	.62	.56	.02	.29	.42	8.01
.23	.86	.63	.58	.03	.30	.43	.03
.24	.88	.64	.60	.04	.32	.44	.04
.25	.90	.65	.62	.05	.34	.45	.06
.26	.91	.66	.64	.06	.36	.46	.08
.27	.93	.67	.65	.07	.38	.47	.10
.28	.95	.68	.67	.08	.39	.48	.12
.29	.97	.69	.69	.09	.41	.49	.13
3.30	5.99	3.70	6.71	4.10	7.43	4.50	8.15
.31	6.00	.71	.73	.11	.45	.51	.17
.32	.02	.72	.74	.12	.47	.52	.19
.33	.04	.73	.76	.13	.48	.53	.21
.34	.06	.74	.78	.14	.50	.54	.22
.35	.08	.75	.80	.15	.52	.55	.24
.36	.09	.76	.82	.16	.54	.56	.26
.37	.11	.77	.83	.17	.56	.57	.28
.38	.13	.78	.85	.18	.57	.58	.30
.39	.15	.79	.87	.19	.59	.59	.31

TABLE 29 (Cont'd)

Salinity

Conversion from chlorinity to salinity (‰)

Cl	S	Cl	S	Cl	S	Cl	S
4.60	8.33	5.00	9.06	5.40	9.78	5.80	10.50
.61	.35	.01	.07	.41	.80	.81	.52
.62	.37	.02	.09	.42	.81	.82	.54
.63	.39	.03	.11	.43	.83	.83	.55
.64	.41	.04	.13	.44	.85	.84	.57
.65	.42	.05	.15	.45	.87	.85	.59
.66	.44	.06	.16	.46	.89	.86	.61
.67	.46	.07	.18	.47	.90	.87	.63
.68	.48	.08	.20	.48	.92	.88	.64
.69	.50	.09	.22	.49	.94	.89	.66
4.70	8.51	5.10	9.24	5.50	9.96	5.90	10.68
.71	.53	.11	.25	.51	.98	.91	.70
.72	.55	.12	.27	.52	.99	.92	.72
.73	.57	.13	.29	.53	10.01	.93	.73
.74	.59	.14	.31	.54	.03	.94	.75
.75	.60	.15	.33	.55	.05	.95	.77
.76	.62	.16	.34	.56	.07	.96	.79
.77	.64	.17	.36	.57	.08	.97	.81
.78	.66	.18	.38	.58	.10	.98	.82
.79	.68	.19	.40	.59	.12	.99	.84
4.80	8.69	5.20	9.42	5.60	10.14	6.00	10.86
.81	.71	.21	.43	.61	.16	.01	.88
.82	.73	.22	.45	.62	.17	.02	.90
.83	.75	.23	.47	.63	.19	.03	.91
.84	.77	.24	.49	.64	.21	.04	.93
.85	.78	.25	.51	.65	.23	.05	.95
.86	.80	.26	.52	.66	.25	.06	.97
.87	.82	.27	.54	.67	.26	.07	.99
.88	.84	.28	.56	.68	.28	.08	11.00
.89	.86	.29	.58	.69	.30	.09	.02
4.90	8.87	5.30	9.60	5.70	10.32	6.10	11.04
.91	.89	.31	.61	.71	.34	.11	.06
.92	.91	.32	.63	.72	.35	.12	.08
.93	.93	.33	.65	.73	.37	.13	.09
.94	.95	.34	.67	.74	.39	.14	.11
.95	.96	.35	.69	.75	.41	.15	.13
.96	.98	.36	.70	.76	.43	.16	.15
.97	9.00	.37	.72	.77	.44	.17	.17
.98	.02	.38	.74	.78	.46	.18	.18
.99	.04	.39	.76	.79	.48	.19	.20

TABLE 29 (Cont'd)

Salinity

Conversion from chlorinity to salinity (‰)

Cl	S	Cl	S	Cl	S	Cl	S
6.20	11.22	6.60	11.94	7.00	12.67	7.40	13.39
.21	.24	.61	.96	.01	.68	.41	.41
.22	.26	.62	.98	.02	.70	.42	.42
.23	.28	.63	12.00	.03	.72	.43	.44
.24	.29	.64	.02	.04	.74	.44	.46
.25	.31	.65	.03	.05	.76	.45	.48
.26	.33	.66	.05	.06	.77	.46	.50
.27	.35	.67	.07	.07	.79	.47	.51
.28	.37	.68	.09	.08	.81	.48	.53
.29	.38	.69	.11	.09	.83	.49	.55
6.30	11.40	6.70	12.12	7.10	12.85	7.50	13.57
.31	.42	.71	.14	.11	.86	.51	.59
.32	.44	.72	.16	.12	.88	.52	.60
.33	.46	.73	.18	.13	.90	.53	.62
.34	.47	.74	.20	.14	.92	.54	.64
.35	.49	.75	.21	.15	.94	.55	.66
.36	.51	.76	.23	.16	.95	.56	.68
.37	.53	.77	.25	.17	.97	.57	.69
.38	.55	.78	.27	.18	.99	.58	.71
.39	.56	.79	.29	.19	13.01	.59	.73
6.40	11.58	6.80	12.30	7.20	13.03	7.60	13.75
.41	.60	.81	.32	.21	.04	.61	.77
.42	.62	.82	.34	.22	.06	.62	.78
.43	.64	.83	.36	.23	.08	.63	.80
.44	.65	.84	.38	.24	.10	.64	.82
.45	.67	.85	.39	.25	.12	.65	.84
.46	.69	.86	.41	.26	.13	.66	.86
.47	.71	.87	.43	.27	.15	.67	.87
.48	.73	.88	.45	.28	.17	.68	.89
.49	.74	.89	.47	.29	.19	.69	.91
6.50	11.76	6.90	12.48	7.30	13.21	7.70	13.93
.51	.78	.91	.50	.31	.22	.71	.95
.52	.80	.92	.52	.32	.24	.72	.96
.53	.82	.93	.54	.33	.26	.73	.98
.54	.83	.94	.56	.34	.28	.74	14.00
.55	.85	.95	.57	.35	.30	.75	.02
.56	.87	.96	.59	.36	.31	.76	.04
.57	.89	.97	.61	.37	.33	.77	.05
.58	.91	.98	.63	.38	.35	.78	.07
.59	.92	.99	.65	.39	.37	.79	.09

TABLE 29 (Cont'd)

Salinity

Conversion from chlorinity to salinity (‰)

Cl	S	Cl	S	Cl	S	Cl	S
7.80	14.11	8.20	14.83	8.60	15.55	9.00	16.28
.81	.13	.21	.85	.61	.57	.01	.29
.82	.15	.22	.87	.62	.59	.02	.31
.83	.16	.23	.89	.63	.61	.03	.33
.84	.18	.24	.90	.64	.63	.04	.35
.85	.20	.25	.92	.65	.64	.05	.37
.86	.22	.26	.94	.66	.66	.06	.38
.87	.24	.27	.96	.67	.68	.07	.40
.88	.25	.28	.98	.68	.70	.08	.42
.89	.27	.29	.99	.69	.72	.09	.44
7.90	14.29	8.30	15.01	8.70	15.73	9.10	16.46
.91	.31	.31	.03	.71	.75	.11	.47
.92	.33	.32	.05	.72	.77	.12	.49
.93	.34	.33	.07	.73	.79	.13	.51
.94	.36	.34	.08	.74	.81	.14	.53
.95	.38	.35	.10	.75	.82	.15	.55
.96	.40	.36	.12	.76	.84	.16	.56
.97	.42	.37	.14	.77	.86	.17	.58
.98	.43	.38	.16	.78	.88	.18	.60
.99	.45	.39	.17	.79	.90	.19	.62
8.00	14.47	8.40	15.19	8.80	15.91	9.20	16.64
.01	.49	.41	.21	.81	.93	.21	.65
.02	.51	.42	.23	.82	.95	.22	.67
.03	.52	.43	.25	.83	.97	.23	.69
.04	.54	.44	.26	.84	.99	.24	.71
.05	.56	.45	.28	.85	16.00	.25	.73
.06	.58	.46	.30	.86	.02	.26	.74
.07	.60	.47	.32	.87	.04	.27	.76
.08	.61	.48	.34	.88	.06	.28	.78
.09	.63	.49	.35	.89	.08	.29	.80
8.10	14.65	8.50	15.37	8.90	16.09	9.30	16.82
.11	.67	.51	.39	.91	.11	.31	.83
.12	.69	.52	.41	.92	.13	.32	.85
.13	.70	.53	.43	.93	.15	.33	.87
.14	.72	.54	.44	.94	.17	.34	.89
.15	.74	.55	.46	.95	.18	.35	.91
.16	.76	.56	.48	.96	.20	.36	.92
.17	.78	.57	.50	.97	.22	.37	.94
.18	.79	.58	.52	.98	.24	.38	.96
.19	.81	.59	.53	.99	.26	.39	.98

TABLE 29 (Cont'd)

Salinity

Conversion from chlorinity to salinity (‰)

Cl	S	Cl	S	Cl	S	Cl	S
9.40	17.00	9.80	17.72	10.20	18.44	10.60	19.16
.41	.02	.81	.74	.21	.46	.61	.18
.42	.03	.82	.76	.22	.48	.62	.20
.43	.05	.83	.77	.23	.50	.63	.22
.44	.07	.84	.79	.24	.51	.64	.24
.45	.09	.85	.81	.25	.53	.65	.25
.46	.11	.86	.83	.26	.55	.66	.27
.47	.12	.87	.85	.27	.57	.67	.29
.48	.14	.88	.86	.28	.59	.68	.31
.49	.16	.89	.88	.29	.60	.69	.33
9.50	17.18	9.90	17.90	10.30	18.62	10.70	19.34
.51	.20	.91	.92	.31	.64	.71	.36
.52	.21	.92	.94	.32	.66	.72	.38
.53	.23	.93	.95	.33	.68	.73	.40
.54	.25	.94	.97	.34	.69	.74	.42
.55	.27	.95	.99	.35	.71	.75	.43
.56	.29	.96	18.01	.36	.73	.76	.45
.57	.30	.97	.03	.37	.75	.77	.47
.58	.32	.98	.04	.38	.77	.78	.49
.59	.34	.99	.06	.39	.78	.79	.51
9.60	17.36	10.00	18.08	10.40	18.80	10.80	19.52
.61	.38	.01	.10	.41	.82	.81	.54
.62	.39	.02	.12	.42	.84	.82	.56
.63	.41	.03	.13	.43	.86	.83	.58
.64	.43	.04	.15	.44	.87	.84	.60
.65	.45	.05	.17	.45	.89	.85	.61
.66	.47	.06	.19	.46	.91	.86	.63
.67	.48	.07	.21	.47	.93	.87	.65
.68	.50	.08	.22	.48	.95	.88	.67
.69	.52	.09	.24	.49	.96	.89	.69
9.70	17.54	10.10	18.26	10.50	18.98	10.90	19.70
.71	.56	.11	.28	.51	19.00	.91	.72
.72	.57	.12	.30	.52	.02	.92	.74
.73	.59	.13	.31	.53	.04	.93	.76
.74	.61	.14	.33	.54	.05	.94	.78
.75	.63	.15	.35	.55	.07	.95	.79
.76	.65	.16	.37	.56	.09	.96	.81
.77	.66	.17	.39	.57	.11	.97	.83
.78	.68	.18	.40	.58	.13	.98	.85
.79	.70	.19	.42	.59	.14	.99	.87

TABLE 29 (Cont'd)

Salinity

Conversion from chlorinity to salinity (‰)

C1	S	C1	S	C1	S	C1	S
11.00	19.89	11.40	20.61	11.80	21.33	12.20	22.05
.01	.90	.41	.63	.81	.35	.21	.07
.02	.92	.42	.64	.82	.37	.22	.09
.03	.94	.43	.66	.83	.38	.23	.11
.04	.96	.44	.68	.84	.40	.24	.12
.05	.98	.45	.70	.85	.42	.25	.14
.06	.99	.46	.72	.86	.44	.26	.16
.07	20.01	.47	.73	.87	.46	.27	.18
.08	.03	.48	.75	.88	.47	.28	.20
.09	.05	.49	.77	.89	.49	.29	.21
11.10	20.07	11.50	20.79	11.90	21.51	12.30	22.23
.11	.08	.51	.81	.91	.53	.31	.25
.12	.10	.52	.82	.92	.55	.32	.27
.13	.12	.53	.84	.93	.56	.33	.29
.14	.14	.54	.86	.94	.58	.34	.30
.15	.16	.55	.88	.95	.60	.35	.32
.16	.17	.56	.90	.96	.62	.36	.34
.17	.19	.57	.91	.97	.64	.37	.36
.18	.21	.58	.93	.98	.65	.38	.38
.19	.23	.59	.95	.99	.67	.39	.39
11.20	20.25	11.60	20.97	12.00	21.69	12.40	22.41
.21	.26	.61	.99	.01	.71	.41	.43
.22	.28	.62	21.00	.02	.73	.42	.45
.23	.30	.63	.02	.03	.74	.43	.47
.24	.32	.64	.04	.04	.76	.44	.48
.25	.34	.65	.06	.05	.78	.45	.50
.26	.35	.66	.08	.06	.80	.46	.52
.27	.37	.67	.09	.07	.82	.47	.54
.28	.39	.68	.11	.08	.83	.48	.56
.29	.41	.69	.13	.09	.85	.49	.57
11.30	20.43	11.70	21.15	12.10	21.87	12.50	22.59
.31	.44	.71	.17	.11	.89	.51	.61
.32	.46	.72	.18	.12	.91	.52	.63
.33	.48	.73	.20	.13	.92	.53	.65
.34	.50	.74	.22	.14	.94	.54	.66
.35	.52	.75	.24	.15	.96	.55	.68
.36	.53	.76	.26	.16	.98	.56	.70
.37	.55	.77	.27	.17	22.00	.57	.72
.38	.57	.78	.29	.18	.01	.58	.74
.39	.59	.79	.31	.19	.03	.59	.75

TABLE 29 (Cont'd)

Salinity

Conversion from chlorinity to salinity (‰)

C1	S	C1	S	C1	S	C1	S
12.60	22.77	13.00	23.50	13.40	24.22	13.80	24.94
.61	.79	.01	.51	.41	.24	.81	.96
.62	.81	.02	.53	.42	.25	.82	.98
.63	.83	.03	.55	.43	.27	.83	.99
.64	.85	.04	.57	.44	.29	.84	25.01
.65	.86	.05	.59	.45	.31	.85	.03
.66	.88	.06	.60	.46	.33	.86	.05
.67	.90	.07	.62	.47	.34	.87	.07
.68	.92	.08	.64	.48	.36	.88	.08
.69	.94	.09	.66	.49	.38	.89	.10
12.70	22.95	13.10	23.68	13.50	24.40	13.90	25.12
.71	.97	.11	.69	.51	.42	.91	.14
.72	.99	.12	.71	.52	.43	.92	.16
.73	23.01	.13	.73	.53	.45	.93	.17
.74	.03	.14	.75	.54	.47	.94	.19
.75	.04	.15	.77	.55	.49	.95	.21
.76	.06	.16	.78	.56	.51	.96	.23
.77	.08	.17	.80	.57	.52	.97	.25
.78	.10	.18	.82	.58	.54	.98	.26
.79	.12	.19	.84	.59	.56	.99	.28
12.80	23.13	13.20	23.86	13.60	24.58	14.00	25.30
.81	.15	.21	.87	.61	.60	.01	.32
.82	.17	.22	.89	.62	.61	.02	.34
.83	.19	.23	.91	.63	.63	.03	.35
.84	.21	.24	.93	.64	.65	.04	.37
.85	.22	.25	.95	.65	.67	.05	.39
.86	.24	.26	.96	.66	.69	.06	.41
.87	.26	.27	.98	.67	.70	.07	.43
.88	.28	.28	24.00	.68	.72	.08	.44
.89	.30	.29	.02	.69	.74	.09	.46
12.90	23.31	13.30	24.04	13.70	24.76	14.10	25.48
.91	.33	.31	.05	.71	.78	.11	.50
.92	.35	.32	.07	.72	.79	.12	.52
.93	.37	.33	.09	.73	.81	.13	.53
.94	.39	.34	.11	.74	.83	.14	.55
.95	.40	.35	.13	.75	.85	.15	.57
.96	.42	.36	.14	.76	.87	.16	.59
.97	.44	.37	.16	.77	.88	.17	.61
.98	.46	.38	.18	.78	.90	.18	.62
.99	.48	.39	.20	.79	.92	.19	.64

TABLE 29 (Cont'd)

Salinity

Conversion from chlorinity to salinity (‰)

Cl	S	Cl	S	Cl	S	Cl	S
14.20	25.66	14.60	26.38	15.00	27.11	15.40	27.83
.21	.68	.61	.40	.01	.12	.41	.85
.22	.70	.62	.42	.02	.14	.42	.86
.23	.72	.63	.44	.03	.16	.43	.88
.24	.73	.64	.46	.04	.18	.44	.90
.25	.75	.65	.47	.05	.20	.45	.92
.26	.77	.66	.49	.06	.21	.46	.94
.27	.79	.67	.51	.07	.23	.47	.95
.28	.81	.68	.53	.08	.25	.48	.97
.29	.82	.69	.55	.09	.27	.49	.99
14.30	25.84	14.70	26.56	15.10	27.29	15.50	28.01
.31	.86	.71	.58	.11	.30	.51	.03
.32	.88	.72	.60	.12	.32	.52	.04
.33	.90	.73	.62	.13	.34	.53	.06
.34	.91	.74	.64	.14	.36	.54	.08
.35	.93	.75	.65	.15	.38	.55	.10
.36	.95	.76	.67	.16	.39	.56	.12
.37	.97	.77	.69	.17	.41	.57	.13
.38	.99	.78	.71	.18	.43	.58	.15
.39	26.00	.79	.73	.19	.45	.59	.17
14.40	26.02	14.80	26.74	15.20	27.47	15.60	28.19
.41	.04	.81	.76	.21	.48	.61	.21
.42	.06	.82	.78	.22	.50	.62	.22
.43	.08	.83	.80	.23	.52	.63	.24
.44	.09	.84	.82	.24	.54	.64	.26
.45	.11	.85	.83	.25	.56	.65	.28
.46	.13	.86	.85	.26	.57	.66	.30
.47	.15	.87	.87	.27	.59	.67	.31
.48	.17	.88	.89	.28	.61	.68	.33
.49	.18	.89	.91	.29	.63	.69	.35
14.50	26.20	14.90	26.92	15.30	27.65	15.70	28.37
.51	.22	.91	.94	.31	.66	.71	.39
.52	.24	.92	.96	.32	.68	.72	.40
.53	.26	.93	.98	.33	.70	.73	.42
.54	.27	.94	27.00	.34	.72	.74	.44
.55	.29	.95	.01	.35	.74	.75	.46
.56	.31	.96	.03	.36	.75	.76	.48
.57	.33	.97	.05	.37	.77	.77	.49
.58	.35	.98	.07	.38	.79	.78	.51
.59	.36	.99	.09	.39	.81	.79	.53

TABLE 29 (Cont'd)

Salinity

Conversion from chlorinity to salinity (‰)

Cl	S	Cl	S	Cl	S	Cl	S
15.80	28.55	16.20	29.27	16.60	29.99	17.00	30.72
.81	.57	.21	.29	.61	30.01	.01	.73
.82	.59	.22	.31	.62	.03	.02	.75
.83	.60	.23	.33	.63	.05	.03	.77
.84	.62	.24	.34	.64	.07	.04	.79
.85	.64	.25	.36	.65	.08	.05	.81
.86	.66	.26	.38	.66	.10	.06	.82
.87	.68	.27	.40	.67	.12	.07	.84
.88	.69	.28	.42	.68	.14	.08	.86
.89	.71	.29	.43	.69	.16	.09	.88
15.90	28.73	16.30	29.45	16.70	30.17	17.10	30.90
.91	.75	.31	.47	.71	.19	.11	.91
.92	.77	.32	.49	.72	.21	.12	.93
.93	.78	.33	.51	.73	.23	.13	.95
.94	.80	.34	.52	.74	.25	.14	.97
.95	.82	.35	.54	.75	.26	.15	.99
.96	.84	.36	.56	.76	.28	.16	31.00
.97	.86	.37	.58	.77	.30	.17	.02
.98	.87	.38	.60	.78	.32	.18	.04
.99	.89	.39	.61	.79	.34	.19	.06
16.00	28.91	16.40	29.63	16.80	30.35	17.20	31.08
.01	.93	.41	.65	.81	.37	.21	.09
.02	.95	.42	.67	.82	.39	.22	.11
.03	.96	.43	.69	.83	.41	.23	.13
.04	.98	.44	.70	.84	.43	.24	.15
.05	29.00	.45	.72	.85	.44	.25	.17
.06	.02	.46	.74	.86	.46	.26	.18
.07	.04	.47	.76	.87	.48	.27	.20
.08	.05	.48	.78	.88	.50	.28	.22
.09	.07	.49	.79	.89	.52	.29	.24
16.10	29.09	16.50	29.81	16.90	30.53	17.30	31.26
.11	.11	.51	.83	.91	.55	.31	.27
.12	.13	.52	.85	.92	.57	.32	.29
.13	.14	.53	.87	.93	.59	.33	.31
.14	.16	.54	.88	.94	.61	.34	.33
.15	.18	.55	.90	.95	.62	.35	.35
.16	.20	.56	.92	.96	.64	.36	.36
.17	.22	.57	.94	.97	.66	.37	.38
.18	.23	.58	.96	.98	.68	.38	.40
.19	.25	.59	.97	.99	.70	.39	.42

TABLE 29 (Cont'd)

Salinity

Conversion from chlorinity to salinity (‰)

C1	S	C1	S	C1	S	C1	S
17.40	31.44	17.80	32.16	18.20	32.88	18.60	33.60
.41	.46	.81	.18	.21	.90	.61	.62
.42	.47	.82	.20	.22	.92	.62	.64
.43	.49	.83	.21	.23	.94	.63	.66
.44	.51	.84	.23	.24	.95	.64	.68
.45	.53	.85	.25	.25	.97	.65	.69
.46	.55	.86	.27	.26	.99	.66	.71
.47	.56	.87	.29	.27	33.01	.67	.73
.48	.58	.88	.30	.28	.03	.68	.75
.49	.60	.89	.32	.29	.04	.69	.77
17.50	31.62	17.90	32.34	18.30	33.06	18.70	33.78
.51	.64	.91	.36	.31	.08	.71	.80
.52	.65	.92	.38	.32	.10	.72	.82
.53	.67	.93	.39	.33	.12	.73	.84
.54	.69	.94	.41	.34	.13	.74	.86
.55	.71	.95	.43	.35	.15	.75	.87
.56	.73	.96	.45	.36	.17	.76	.89
.57	.74	.97	.47	.37	.19	.77	.91
.58	.76	.98	.48	.38	.21	.78	.93
.59	.78	.99	.50	.39	.22	.79	.95
17.60	31.80	18.00	32.52	18.40	33.24	18.80	33.96
.61	.82	.01	.54	.41	.26	.81	.98
.62	.83	.02	.56	.42	.28	.82	34.00
.63	.85	.03	.57	.43	.30	.83	.02
.64	.87	.04	.59	.44	.31	.84	.04
.65	.89	.05	.61	.45	.33	.85	.05
.66	.91	.06	.63	.46	.35	.86	.07
.67	.92	.07	.65	.47	.37	.87	.09
.68	.94	.08	.66	.48	.39	.88	.11
.69	.96	.09	.68	.49	.40	.89	.13
17.70	31.98	18.10	32.70	18.50	33.42	18.90	34.14
.71	32.00	.11	.72	.51	.44	.91	.16
.72	.01	.12	.74	.52	.46	.92	.18
.73	.03	.13	.75	.53	.48	.93	.20
.74	.05	.14	.77	.54	.49	.94	.22
.75	.07	.15	.79	.55	.51	.95	.23
.76	.09	.16	.81	.56	.53	.96	.25
.77	.10	.17	.83	.57	.55	.97	.27
.78	.12	.18	.84	.58	.57	.98	.29
.79	.14	.19	.86	.59	.58	.99	.31

TABLE 29 (Cont'd)

Salinity

Conversion from chlorinity to salinity (‰)

C1	S	C1	S	C1	S	C1	S
19.00	34.33	19.40	35.05	19.80	35.77	20.20	36.49
.01	.34	.41	.07	.81	.79	.21	.51
.02	.36	.42	.08	.82	.81	.22	.53
.03	.38	.43	.10	.83	.82	.23	.55
.04	.40	.44	.12	.84	.84	.24	.56
.05	.42	.45	.14	.85	.86	.25	.58
.06	.43	.46	.16	.86	.88	.26	.60
.07	.45	.47	.17	.87	.90	.27	.62
.08	.47	.48	.19	.88	.91	.28	.64
.09	.49	.49	.21	.89	.93	.29	.65
19.10	34.51	19.50	35.23	19.90	35.95	20.30	36.67
.11	.52	.51	.25	.91	.97	.31	.69
.12	.54	.52	.26	.92	.99	.32	.71
.13	.56	.53	.28	.93	36.00	.33	.73
.14	.58	.54	.30	.94	.02	.34	.74
.15	.60	.55	.32	.95	.04	.35	.76
.16	.61	.56	.34	.96	.06	.36	.78
.17	.63	.57	.35	.97	.08	.37	.80
.18	.65	.58	.37	.98	.09	.38	.82
.19	.67	.59	.39	.99	.11	.39	.83
19.20	34.69	19.60	35.41	20.00	36.13	20.40	36.85
.21	.70	.61	.43	.01	.15	.41	.87
.22	.72	.62	.44	.02	.17	.42	.89
.23	.74	.63	.46	.03	.18	.43	.91
.24	.76	.64	.48	.04	.20	.44	.92
.25	.78	.65	.50	.05	.22	.45	.94
.26	.79	.66	.52	.06	.24	.46	.96
.27	.81	.67	.53	.07	.26	.47	.98
.28	.83	.68	.55	.08	.27	.48	37.00
.29	.85	.69	.57	.09	.29	.49	.01
19.30	34.87	19.70	35.59	20.10	36.31	20.50	37.03
.31	.88	.71	.61	.11	.33	.51	.05
.32	.90	.72	.62	.12	.35	.52	.07
.33	.92	.73	.64	.13	.36	.53	.09
.34	.94	.74	.66	.14	.38	.54	.10
.35	.96	.75	.68	.15	.40	.55	.12
.36	.97	.76	.70	.16	.42	.56	.14
.37	.99	.77	.71	.17	.44	.57	.16
.38	35.01	.78	.73	.18	.45	.58	.18
.39	.03	.79	.75	.19	.47	.59	.19

TABLE 29 (Cont'd)

Salinity

Conversion from chlorinity to salinity (‰)

C1	S	C1	S	C1	S	C1	S
20.60	37.21	21.00	37.94	21.40	38.66	21.80	39.38
.61	.23	.01	.95	.41	.68	.81	.40
.62	.25	.02	.97	.42	.69	.82	.42
.63	.27	.03	.99	.43	.71	.83	.43
.64	.29	.04	38.01	.44	.73	.84	.45
.65	.30	.05	.03	.45	.75	.85	.47
.66	.32	.06	.04	.46	.77	.86	.49
.67	.34	.07	.06	.47	.78	.87	.51
.68	.36	.08	.08	.48	.80	.88	.52
.69	.38	.09	.10	.49	.82	.89	.54
20.70	37.39	21.10	38.12	21.50	38.84	21.90	39.56
.71	.41	.11	.13	.51	.86	.91	.58
.72	.43	.12	.15	.52	.87	.92	.60
.73	.45	.13	.17	.53	.89	.93	.61
.74	.47	.14	.19	.54	.91	.94	.63
.75	.48	.15	.21	.55	.93	.95	.65
.76	.50	.16	.22	.56	.95	.96	.67
.77	.52	.17	.24	.57	.96	.97	.69
.78	.54	.18	.26	.58	.98	.98	.70
.79	.56	.19	.28	.59	39.00	.99	.72
20.80	37.57	21.20	38.30	21.60	39.02	22.00	39.74
.81	.59	.21	.31	.61	.04	.01	.76
.82	.61	.22	.33	.62	.05	.02	.78
.83	.63	.23	.35	.63	.07	.03	.79
.84	.65	.24	.37	.64	.09	.04	.81
.85	.66	.25	.39	.65	.11	.05	.83
.86	.68	.26	.40	.66	.13	.06	.85
.87	.70	.27	.42	.67	.14	.07	.87
.88	.72	.28	.44	.68	.16	.08	.88
.89	.74	.29	.46	.69	.18	.09	.90
20.90	37.75	21.30	38.48	21.70	39.20	22.10	39.92
.91	.77	.31	.49	.71	.22	.11	.94
.92	.79	.32	.51	.72	.23	.12	.96
.93	.81	.33	.53	.73	.25	.13	.97
.94	.83	.34	.55	.74	.27	.14	.99
.95	.84	.35	.57	.75	.29	.15	40.01
.96	.86	.36	.58	.76	.31	.16	.03
.97	.88	.37	.60	.77	.32	.17	.05
.98	.90	.38	.62	.78	.34	.18	.06
.99	.92	.39	.64	.79	.36	.19	.08

TABLE 29 (Cont'd)

Salinity

Conversion from chlorinity to salinity (‰)

C1	S	C1	S
22.20	40.10	22.60	40.82
.21	.12	.61	.84
.22	.14	.62	.86
.23	.16	.63	.88
.24	.17	.64	.90
.25	.19	.65	.91
.26	.21	.66	.93
.27	.23	.67	.95
.28	.25	.68	.97
.29	.26	.69	.99
22.30	40.28	22.70	41.00
.31	.30	.71	.02
.32	.32	.72	.04
.33	.34	.73	.06
.34	.35	.74	.08
.35	.37	.75	.09
.36	.39	.76	.11
.37	.41	.77	.13
.38	.43	.78	.15
.39	.44	.79	.17
22.40	40.46	22.80	41.18
.41	.48	.81	.20
.42	.50	.82	.22
.43	.52	.83	.24
.44	.53	.84	.26
.45	.55	.85	.27
.46	.57	.86	.29
.47	.59	.87	.31
.48	.61	.88	.33
.49	.62	.89	.35
22.50	40.64	22.90	41.36
.51	.66	.91	.38
.52	.68	.92	.40
.53	.70	.93	.42
.54	.71	.94	.44
.55	.73	.95	.45
.56	.75	.96	.47
.57	.77	.97	.49
.58	.79	.98	.51
.59	.80	.99	.53
		23.00	41.55

TABLE 30

Oxygen

Conversion from milligrams per liter to milliliters per liter (NTP)
 (1 mg/l = 0.6998 ml/l)

Milligrams per Liter of O ₂	.00	.01	.02	.03	.04	.05	.06	.07	.08	.09
0.0	0.00	0.01	0.01	0.02	0.03	0.03	0.04	0.05	0.06	0.06
0.1	0.07	0.08	0.08	0.09	0.10	0.10	0.11	0.12	0.13	0.13
0.2	0.14	0.15	0.15	0.16	0.17	0.17	0.18	0.19	0.20	0.20
0.3	0.21	0.22	0.22	0.23	0.24	0.24	0.25	0.26	0.27	0.27
0.4	0.28	0.29	0.29	0.30	0.31	0.31	0.32	0.33	0.34	0.34
0.5	0.35	0.36	0.36	0.37	0.38	0.38	0.39	0.40	0.41	0.41
0.6	0.42	0.43	0.43	0.44	0.45	0.45	0.46	0.47	0.48	0.48
0.7	0.49	0.50	0.50	0.51	0.52	0.52	0.53	0.54	0.55	0.55
0.8	0.56	0.57	0.57	0.58	0.59	0.59	0.60	0.61	0.62	0.62
0.9	0.63	0.64	0.64	0.65	0.66	0.66	0.67	0.68	0.69	0.69

milligrams/liter	milliliters/liter	milligrams/liter	milliliters/liter
1.0	0.70	12.0	8.40
2.0	1.40	13.0	9.10
3.0	2.10	14.0	9.80
4.0	2.80	15.0	10.50
5.0	3.50	16.0	11.20
6.0	4.20	17.0	11.90
7.0	4.90	18.0	12.60
8.0	5.60	19.0	13.30
9.0	6.30	20.0	14.00
10.0	7.00	21.0	14.70
11.0	7.70	22.0	15.40

Example: Convert 5.65 milligrams/liter of O₂ to milliliters/liter.

$$\begin{array}{r}
 5.00 \text{ milligrams/liter} = 3.50 \\
 0.65 \text{ milligrams/liter} = 0.45 \\
 \hline
 3.95 \text{ milliliters/liter (ans.)}
 \end{array}$$

TABLE 31

Oxygen

Conversion from milligram-atoms per liter to milliliters per liter
 (1 milligram-atom per liter of O_2 = 11.196 milliliters per liter of O_2)

Milligram- atoms/liter of O_2	.000	.001	.002	.003	.004	.005	.006	.007	.008	.009
0.00	0.00	0.01	0.02	0.03	0.04	0.06	0.07	0.08	0.09	0.10
0.01	0.11	0.12	0.13	0.15	0.16	0.17	0.18	0.19	0.20	0.21
0.02	0.22	0.24	0.25	0.26	0.27	0.28	0.29	0.30	0.31	0.32
0.03	0.34	0.35	0.36	0.37	0.38	0.39	0.40	0.41	0.43	0.44
0.04	0.45	0.46	0.47	0.48	0.49	0.50	0.52	0.53	0.54	0.55
0.05	0.56	0.57	0.58	0.59	0.60	0.62	0.63	0.64	0.65	0.66
0.06	0.67	0.68	0.69	0.71	0.72	0.73	0.74	0.75	0.76	0.77
0.07	0.78	0.79	0.81	0.82	0.83	0.84	0.85	0.86	0.87	0.88
0.08	0.90	0.91	0.92	0.93	0.94	0.95	0.96	0.97	0.99	1.00
0.09	1.01	1.02	1.03	1.04	1.05	1.06	1.07	1.09	1.10	1.11
0.10	1.12	1.13	1.14	1.15	1.16	1.18	1.19	1.20	1.21	1.22
0.11	1.23	1.24	1.25	1.27	1.28	1.29	1.30	1.31	1.32	1.33
0.12	1.34	1.35	1.37	1.38	1.39	1.40	1.41	1.42	1.43	1.44
0.13	1.46	1.47	1.48	1.49	1.50	1.51	1.52	1.53	1.55	1.56
0.14	1.57	1.58	1.59	1.60	1.61	1.62	1.63	1.65	1.66	1.67
0.15	1.68	1.69	1.70	1.71	1.72	1.74	1.75	1.76	1.77	1.78
0.16	1.79	1.80	1.81	1.82	1.84	1.85	1.86	1.87	1.88	1.89
0.17	1.90	1.91	1.93	1.94	1.95	1.96	1.97	1.98	1.99	2.00
0.18	2.02	2.03	2.04	2.05	2.06	2.07	2.08	2.09	2.10	2.12
0.19	2.13	2.14	2.15	2.16	2.17	2.18	2.19	2.21	2.22	2.23
0.20	2.24	2.25	2.26	2.27	2.28	2.30	2.31	2.32	2.33	2.34
0.21	2.35	2.36	2.37	2.38	2.40	2.41	2.42	2.43	2.44	2.45
0.22	2.46	2.47	2.49	2.50	2.51	2.52	2.53	2.54	2.55	2.56
0.23	2.58	2.59	2.60	2.61	2.62	2.63	2.64	2.65	2.66	2.68
0.24	2.69	2.70	2.71	2.72	2.73	2.74	2.75	2.77	2.78	2.79
0.25	2.80	2.81	2.82	2.83	2.84	2.85	2.87	2.88	2.89	2.90
0.26	2.91	2.92	2.93	2.94	2.96	2.97	2.98	2.99	3.00	3.01
0.27	3.02	3.03	3.05	3.06	3.07	3.08	3.09	3.10	3.11	3.12
0.28	3.13	3.15	3.16	3.17	3.18	3.19	3.20	3.21	3.22	3.24
0.29	3.25	3.26	3.27	3.28	3.29	3.30	3.31	3.33	3.34	3.35
0.30	3.36	3.37	3.38	3.39	3.40	3.41	3.43	3.44	3.45	3.46

TABLE 31 (Cont'd)

Oxygen

Conversion from milligram-atoms per liter to milliliters per liter
 (1 milligram-atom per liter of O_2 = 11.196 milliliters per liter of O_2)

Milligram-atoms/liter of O_2	.000	.001	.002	.003	.004	.005	.006	.007	.008	.009
0.31	3.47	3.48	3.49	3.50	3.52	3.53	3.54	3.55	3.56	3.57
0.32	3.58	3.59	3.61	3.62	3.63	3.64	3.65	3.66	3.67	3.68
0.33	3.69	3.71	3.72	3.73	3.74	3.75	3.76	3.77	3.78	3.80
0.34	3.81	3.82	3.83	3.84	3.85	3.86	3.87	3.89	3.90	3.91
0.35	3.92	3.93	3.94	3.95	3.96	3.97	3.99	4.00	4.01	4.02
0.36	4.03	4.04	4.05	4.06	4.08	4.09	4.10	4.11	4.12	4.13
0.37	4.14	4.15	4.16	4.18	4.19	4.20	4.21	4.22	4.23	4.24
0.38	4.25	4.27	4.28	4.29	4.30	4.31	4.32	4.33	4.34	4.36
0.39	4.37	4.38	4.39	4.40	4.41	4.42	4.43	4.44	4.46	4.47
0.40	4.48	4.49	4.50	4.51	4.52	4.53	4.55	4.56	4.57	4.58
0.41	4.59	4.60	4.61	4.62	4.64	4.65	4.66	4.67	4.68	4.69
0.42	4.70	4.71	4.72	4.74	4.75	4.76	4.77	4.78	4.79	4.80
0.43	4.81	4.83	4.84	4.85	4.86	4.87	4.88	4.89	4.90	4.92
0.44	4.93	4.94	4.95	4.96	4.97	4.98	4.99	5.00	5.02	5.03
0.45	5.04	5.05	5.06	5.07	5.08	5.09	5.11	5.12	5.13	5.14
0.46	5.15	5.16	5.17	5.18	5.19	5.21	5.22	5.23	5.24	5.25
0.47	5.26	5.27	5.28	5.30	5.31	5.32	5.33	5.34	5.35	5.36
0.48	5.37	5.39	5.40	5.41	5.42	5.43	5.44	5.45	5.46	5.47
0.49	5.49	5.50	5.51	5.52	5.53	5.54	5.55	5.56	5.58	5.59
0.50	5.60	5.61	5.62	5.63	5.64	5.65	5.67	5.68	5.69	5.70
0.51	5.71	5.72	5.73	5.74	5.75	5.77	5.78	5.79	5.80	5.81
0.52	5.82	5.83	5.84	5.86	5.87	5.88	5.89	5.90	5.91	5.92
0.53	5.93	5.95	5.96	5.97	5.98	5.99	6.00	6.01	6.02	6.03
0.54	6.05	6.06	6.07	6.08	6.09	6.10	6.11	6.12	6.14	6.15
0.55	6.16	6.17	6.18	6.19	6.20	6.21	6.22	6.24	6.25	6.26
0.56	6.27	6.28	6.29	6.30	6.31	6.33	6.34	6.35	6.36	6.37
0.57	6.38	6.39	6.40	6.42	6.43	6.44	6.45	6.46	6.47	6.48
0.58	6.49	6.50	6.52	6.53	6.54	6.55	6.56	6.57	6.58	6.59
0.59	6.61	6.62	6.63	6.64	6.65	6.66	6.67	6.68	6.70	6.71
0.60	6.72	6.73	6.74	6.75	6.76	6.77	6.78	6.80	6.81	6.82

TABLE 31 (Cont'd)

Oxygen

Conversion from milligram-atoms per liter to milliliters per liter
 (1 milligram-atom per liter of O_2 = 11.196 milliliters per liter of O_2)

Milligram-atoms/liter of O_2	.000	.001	.002	.003	.004	.005	.006	.007	.008	.009
0.61	6.83	6.84	6.85	6.86	6.87	6.89	6.90	6.91	6.92	6.93
0.62	6.94	6.95	6.96	6.98	6.99	7.00	7.01	7.02	7.03	7.04
0.63	7.05	7.06	7.08	7.09	7.10	7.11	7.12	7.13	7.14	7.15
0.64	7.17	7.18	7.19	7.20	7.21	7.22	7.23	7.24	7.26	7.27
0.65	7.28	7.29	7.30	7.31	7.32	7.33	7.34	7.36	7.37	7.38
0.66	7.39	7.40	7.41	7.42	7.43	7.45	7.46	7.47	7.48	7.49
0.67	7.50	7.51	7.52	7.53	7.55	7.56	7.57	7.58	7.59	7.60
0.68	7.61	7.62	7.64	7.65	7.66	7.67	7.68	7.69	7.70	7.71
0.69	7.73	7.74	7.75	7.76	7.77	7.78	7.79	7.80	7.81	7.83
0.70	7.84	7.85	7.86	7.87	7.88	7.89	7.90	7.92	7.93	7.94
0.71	7.95	7.96	7.97	7.98	7.99	8.01	8.02	8.03	8.04	8.05
0.72	8.06	8.07	8.08	8.09	8.11	8.12	8.13	8.14	8.15	8.16
0.73	8.17	8.18	8.20	8.21	8.22	8.23	8.24	8.25	8.26	8.27
0.74	8.29	8.30	8.31	8.32	8.33	8.34	8.35	8.36	8.37	8.39
0.75	8.40	8.41	8.42	8.43	8.44	8.45	8.46	8.48	8.49	8.50
0.76	8.51	8.52	8.53	8.54	8.55	8.56	8.58	8.59	8.60	8.61
0.77	8.62	8.63	8.64	8.65	8.67	8.68	8.69	8.70	8.71	8.72
0.78	8.73	8.74	8.76	8.77	8.78	8.79	8.80	8.81	8.82	8.83
0.79	8.84	8.86	8.87	8.88	8.89	8.90	8.91	8.92	8.93	8.95
0.80	8.96	8.97	8.98	8.99	9.00	9.01	9.02	9.04	9.05	9.06
0.81	9.07	9.08	9.09	9.10	9.11	9.12	9.14	9.15	9.16	9.17
0.82	9.18	9.19	9.20	9.21	9.23	9.24	9.25	9.26	9.27	9.28
0.83	9.29	9.30	9.32	9.33	9.34	9.35	9.36	9.37	9.38	9.39
0.84	9.40	9.42	9.43	9.44	9.45	9.46	9.47	9.48	9.49	9.51
0.85	9.52	9.53	9.54	9.55	9.56	9.57	9.58	9.59	9.61	9.62
0.86	9.63	9.64	9.65	9.66	9.67	9.68	9.70	9.71	9.72	9.73
0.87	9.74	9.75	9.76	9.77	9.79	9.80	9.81	9.82	9.83	9.84
0.88	9.85	9.86	9.87	9.89	9.90	9.91	9.92	9.93	9.94	9.95
0.89	9.96	9.98	9.99	10.00	10.01	10.02	10.03	10.04	10.05	10.07
0.90	10.08	10.09	10.10	10.11	10.12	10.13	10.14	10.15	10.17	10.18

TABLE 31 (Cont'd)

Oxygen

Conversion from milligram-atoms per liter to milliliters per liter
(1 milligram-atom per liter of O_2 = 11.196 milliliters per liter of O_2)

Milligram- atoms/liter of O_2	.000	.001	.002	.003	.004	.005	.006	.007	.008	.009
0.91	10.19	10.20	10.21	10.22	10.23	10.24	10.26	10.27	10.28	10.29
0.92	10.30	10.31	10.32	10.33	10.35	10.36	10.37	10.38	10.39	10.40
0.93	10.41	10.42	10.43	10.45	10.46	10.47	10.48	10.49	10.50	10.51
0.94	10.52	10.54	10.55	10.56	10.57	10.58	10.59	10.60	10.61	10.63
0.95	10.64	10.65	10.66	10.67	10.68	10.69	10.70	10.71	10.73	10.74
0.96	10.75	10.76	10.77	10.78	10.79	10.80	10.82	10.83	10.84	10.85
0.97	10.86	10.87	10.88	10.89	10.90	10.92	10.93	10.94	10.95	10.96
0.98	10.97	10.98	10.99	11.01	11.02	11.03	11.04	11.05	11.06	11.07
0.99	11.08	11.10	11.11	11.12	11.13	11.14	11.15	11.16	11.17	11.18
1.00	11.20	11.21	11.22	11.23	11.24	11.25	11.26	11.27	11.29	11.30
1.01	11.31	11.32	11.33	11.34	11.35	11.36	11.38	11.39	11.40	11.41
1.02	11.42	11.43	11.44	11.45	11.46	11.48	11.49	11.50	11.51	11.52
1.03	11.53	11.54	11.55	11.57	11.58	11.59	11.60	11.61	11.62	11.63
1.04	11.64	11.66	11.67	11.68	11.69	11.70	11.71	11.72	11.73	11.74
1.05	11.76	11.77	11.78	11.79	11.80	11.81	11.82	11.83	11.85	11.86
1.06	11.87	11.88	11.89	11.90	11.91	11.92	11.93	11.95	11.96	11.97
1.07	11.98	11.99	12.00	12.01	12.02	12.04	12.05	12.06	12.07	12.08
1.08	12.09	12.10	12.11	12.13	12.14	12.15	12.16	12.17	12.18	12.19
1.09	12.20	12.21	12.23	12.24	12.25	12.26	12.27	12.28	12.29	12.30
1.10	12.32	12.33	12.34	12.35	12.36	12.37	12.38	12.39	12.41	12.42
1.11	12.43	12.44	12.45	12.46	12.47	12.48	12.49	12.51	12.52	12.53
1.12	12.54	12.55	12.56	12.57	12.58	12.60	12.61	12.62	12.63	12.64
1.13	12.65	12.66	12.67	12.69	12.70	12.71	12.72	12.73	12.74	12.75
1.14	12.76	12.77	12.79	12.80	12.81	12.82	12.83	12.84	12.85	12.86
1.15	12.88	12.89	12.90	12.91	12.92	12.93	12.94	12.95	12.96	12.98
1.16	12.99	13.00	13.01	13.02	13.03	13.04	13.05	13.07	13.08	13.09
1.17	13.10	13.11	13.12	13.13	13.14	13.16	13.17	13.18	13.19	13.20
1.18	13.21	13.22	13.23	13.24	13.26	13.27	13.28	13.29	13.30	13.31
1.19	13.32	13.33	13.35	13.36	13.37	13.38	13.39	13.40	13.41	13.42
1.20	13.44	13.45	13.46	13.47	13.48	13.49	13.50	13.51	13.52	13.54

TABLE 31 (Cont'd)

Oxygen

Conversion from milligram-atoms per liter to milliliters per liter
 (1 milligram-atom per liter of O_2 = 11.196 milliliters per liter of O_2)

Milligram-atoms/liter of O_2	.000	.001	.002	.003	.004	.005	.006	.007	.008	.009
1.21	13.55	13.56	13.57	13.58	13.59	13.60	13.61	13.63	13.64	13.65
1.22	13.66	13.67	13.68	13.69	13.70	13.72	13.73	13.74	13.75	13.76
1.23	13.77	13.78	13.79	13.80	13.82	13.83	13.84	13.85	13.86	13.87
1.24	13.88	13.89	13.91	13.92	13.93	13.94	13.95	13.96	13.97	13.98
1.25	14.00	14.01	14.02	14.03	14.04	14.05	14.06	14.07	14.08	14.10
1.26	14.11	14.12	14.13	14.14	14.15	14.16	14.17	14.19	14.20	14.21
1.27	14.22	14.23	14.24	14.25	14.26	14.27	14.29	14.30	14.31	14.32
1.28	14.33	14.34	14.35	14.36	14.38	14.39	14.40	14.41	14.42	14.43
1.29	14.44	14.45	14.47	14.48	14.49	14.50	14.51	14.52	14.53	14.54
1.30	14.55	14.57	14.58	14.59	14.60	14.61	14.62	14.63	14.64	14.66
1.31	14.67	14.68	14.69	14.70	14.71	14.72	14.73	14.75	14.76	14.77
1.32	14.78	14.79	14.80	14.81	14.82	14.83	14.85	14.86	14.87	14.88
1.33	14.89	14.90	14.91	14.92	14.94	14.95	14.96	14.97	14.98	14.99
1.34	15.00									

TABLE 32

Phosphorus

Conversion from micrograms per liter of inorganic P
to microgram-atoms per liter of P

(1 μg of P = 0.032285 $\mu\text{g-at}$ of P)

Micrograms per Liter of inorganic P	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
00	0.00	0.00	0.01	0.01	0.01	0.02	0.02	0.02	0.03	0.03

Micrograms per Liter of in- organic P	0.0	1.0	2.0	3.0	4.0	5.0	6.0	7.0	8.0	9.0
00	0.00	0.03	0.06	0.10	0.13	0.16	0.19	0.23	0.26	0.29
10	0.32	0.36	0.39	0.42	0.45	0.48	0.52	0.55	0.58	0.61
20	0.65	0.68	0.71	0.74	0.77	0.81	0.84	0.87	0.90	0.94
30	0.97	1.00	1.03	1.07	1.10	1.13	1.16	1.19	1.23	1.26
40	1.29	1.32	1.36	1.39	1.42	1.45	1.49	1.52	1.55	1.58
50	1.61	1.65	1.68	1.71	1.74	1.78	1.81	1.84	1.87	1.90
60	1.94	1.97	2.00	2.03	2.07	2.10	2.13	2.16	2.20	2.23
70	2.26	2.29	2.32	2.36	2.39	2.42	2.45	2.49	2.52	2.55
80	2.58	2.62	2.65	2.68	2.71	2.74	2.78	2.81	2.84	2.87
90	2.91	2.94	2.97	3.00	3.03	3.07	3.10	3.13	3.16	3.20
100	3.23	3.26	3.29	3.33	3.36	3.39	3.42	3.45	3.49	3.52
110	3.55	3.58	3.62	3.65	3.68	3.71	3.75	3.78	3.81	3.84
120	3.87	3.91	3.94	3.97	4.00	4.04	4.07	4.10	4.13	4.16

TABLE 33

Phosphate

Conversion from micrograms per liter of PO_4 to
microgram-atoms per liter of $\text{PO}_4\text{-P}$

(1 μg of PO_4 = 0.010529 $\mu\text{g-at}$ of $\text{PO}_4\text{-P}$)

Micrograms per Liter of PO_4	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
00	0.00	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.01	0.01

Micrograms per Liter of PO_4	0.0	1.0	2.0	3.0	4.0	5.0	6.0	7.0	8.0	9.0
00	0.00	0.01	0.02	0.03	0.04	0.05	0.06	0.07	0.08	0.09
10	0.11	0.12	0.13	0.14	0.15	0.16	0.17	0.18	0.19	0.20
20	0.21	0.22	0.23	0.24	0.25	0.26	0.27	0.28	0.29	0.31
30	0.32	0.33	0.34	0.35	0.36	0.37	0.38	0.39	0.40	0.41
40	0.42	0.43	0.44	0.45	0.46	0.47	0.48	0.49	0.51	0.52
50	0.53	0.54	0.55	0.56	0.57	0.58	0.59	0.60	0.61	0.62
60	0.63	0.64	0.65	0.66	0.67	0.68	0.69	0.71	0.72	0.73
70	0.74	0.75	0.76	0.77	0.78	0.79	0.80	0.81	0.82	0.83
80	0.84	0.85	0.86	0.87	0.88	0.89	0.91	0.92	0.93	0.94
90	0.95	0.96	0.97	0.98	0.99	1.00	1.01	1.02	1.03	1.04
100	1.05	1.06	1.07	1.08	1.10	1.11	1.12	1.13	1.14	1.15
110	1.16	1.17	1.18	1.19	1.20	1.21	1.22	1.23	1.24	1.25
120	1.26	1.27	1.28	1.30	1.31	1.32	1.33	1.34	1.35	1.36
130	1.37	1.38	1.39	1.40	1.41	1.42	1.43	1.44	1.45	1.46
140	1.47	1.48	1.50	1.51	1.52	1.53	1.54	1.55	1.56	1.57
150	1.58	1.59	1.60	1.61	1.62	1.63	1.64	1.65	1.66	1.67
160	1.68	1.70	1.71	1.72	1.73	1.74	1.75	1.76	1.77	1.78
170	1.79	1.80	1.81	1.82	1.83	1.84	1.85	1.86	1.87	1.88
180	1.90	1.91	1.92	1.93	1.94	1.95	1.96	1.97	1.98	1.99
190	2.00	2.01	2.02	2.03	2.04	2.05	2.06	2.07	2.08	2.10
200	2.11	2.12	2.13	2.14	2.15	2.16	2.17	2.18	2.19	2.20
210	2.21	2.22	2.23	2.24	2.25	2.26	2.27	2.28	2.30	2.31
220	2.32	2.33	2.34	2.35	2.36	2.37	2.38	2.39	2.40	2.41
230	2.42	2.43	2.44	2.45	2.46	2.47	2.48	2.50	2.51	2.52
240	2.53	2.54	2.55	2.56	2.57	2.58	2.59	2.60	2.61	2.62
250	2.63	2.64	2.65	2.66	2.67	2.68	2.70	2.71	2.72	2.73

TABLE 33 (Cont'd)

Phosphate

Conversion from micrograms per liter of PO_4 to
microgram-atoms per liter of $\text{PO}_4\text{-P}$

Micrograms per Liter of PO_4	0.0	1.0	2.0	3.0	4.0	5.0	6.0	7.0	8.0	9.0
260	2.74	2.75	2.76	2.77	2.78	2.79	2.80	2.81	2.82	2.83
270	2.84	2.85	2.86	2.87	2.88	2.90	2.91	2.92	2.93	2.94
280	2.95	2.96	2.97	2.98	2.99	3.00	3.01	3.02	3.03	3.04
290	3.05	3.06	3.07	3.08	3.10	3.11	3.12	3.13	3.14	3.15
300	3.16	3.17	3.18	3.19	3.20	3.21	3.22	3.23	3.24	3.25
310	3.26	3.27	3.29	3.30	3.31	3.32	3.33	3.34	3.35	3.36
320	3.37	3.38	3.39	3.40	3.41	3.42	3.43	3.44	3.45	3.46
330	3.47	3.49	3.50	3.51	3.52	3.53	3.54	3.55	3.56	3.57
340	3.58	3.59	3.60	3.61	3.62	3.63	3.64	3.65	3.66	3.67
350	3.69	3.70	3.71	3.72	3.73	3.74	3.75	3.76	3.77	3.78

TABLE 34

Phosphorus Pentoxide

Conversion from micrograms per liter of P_2O_5 to microgram-atoms per liter of P
(1 μg of P_2O_5 = 0.014090 μg -atom of P)

Micrograms per Liter of P_2O_5	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
00	0.00	0.00	0.00	0.00	0.01	0.01	0.01	0.01	0.01	0.01
Micrograms per Liter of P_2O_5	0.0	1.0	2.0	3.0	4.0	5.0	6.0	7.0	8.0	9.0
00	0.00	0.01	0.03	0.04	0.06	0.07	0.08	0.10	0.11	0.13
10	0.14	0.15	0.17	0.18	0.20	0.21	0.23	0.24	0.25	0.27
20	0.28	0.30	0.31	0.32	0.34	0.35	0.37	0.38	0.39	0.41
30	0.42	0.44	0.45	0.46	0.48	0.49	0.51	0.52	0.54	0.55
40	0.56	0.58	0.59	0.61	0.62	0.63	0.65	0.66	0.68	0.69
50	0.70	0.72	0.73	0.75	0.76	0.77	0.79	0.80	0.82	0.83
60	0.85	0.86	0.87	0.89	0.90	0.92	0.93	0.94	0.96	0.97
70	0.99	1.00	1.01	1.03	1.04	1.06	1.07	1.08	1.10	1.11
80	1.13	1.14	1.16	1.17	1.18	1.20	1.21	1.23	1.24	1.25
90	1.27	1.28	1.30	1.31	1.32	1.34	1.35	1.37	1.38	1.39
100	1.41	1.42	1.44	1.45	1.47	1.48	1.49	1.51	1.52	1.54
110	1.55	1.56	1.58	1.59	1.61	1.62	1.63	1.65	1.66	1.68
120	1.69	1.70	1.72	1.73	1.75	1.76	1.78	1.79	1.80	1.82
130	1.83	1.85	1.86	1.87	1.89	1.90	1.92	1.93	1.94	1.96
140	1.97	1.99	2.00	2.01	2.03	2.04	2.06	2.07	2.09	2.10
150	2.11	2.13	2.14	2.16	2.17	2.18	2.20	2.21	2.23	2.24
160	2.25	2.27	2.28	2.30	2.31	2.32	2.34	2.35	2.37	2.38
170	2.40	2.41	2.42	2.44	2.45	2.47	2.48	2.49	2.51	2.52
180	2.54	2.55	2.56	2.58	2.59	2.61	2.62	2.63	2.65	2.66
190	2.68	2.69	2.71	2.72	2.73	2.75	2.76	2.78	2.79	2.80
200	2.82	2.83	2.85	2.86	2.87	2.89	2.90	2.92	2.93	2.94
210	2.96	2.97	2.99	3.00	3.02	3.03	3.04	3.06	3.07	3.09
220	3.10	3.11	3.13	3.14	3.16	3.17	3.18	3.20	3.21	3.23
230	3.24	3.25	3.27	3.28	3.30	3.31	3.33	3.34	3.35	3.37
240	3.38	3.40	3.41	3.42	3.44	3.45	3.47	3.48	3.49	3.51
250	3.52	3.54	3.55	3.56	3.58	3.59	3.61	3.62	3.64	3.65

Note: For values greater than 259, the conversion is to be obtained by addition.

TABLE 35

Nitrite

Conversion from micrograms per liter of NO_2 to microgram-atoms per liter of $\text{NO}_2\text{-N}$
 (1 μg of NO_2 = 0.0217365 μg - at of $\text{NO}_2\text{-N}$)

Micrograms per Liter of NO_2	0.0	1.0	2.0	3.0	4.0	5.0	6.0	7.0	8.0	9.0
00	0.00	0.02	0.04	0.07	0.09	0.11	0.13	0.15	0.17	0.20
10	0.22	0.24	0.26	0.28	0.30	0.33	0.35	0.37	0.39	0.41
20	0.43	0.46	0.48	0.50	0.52	0.54	0.57	0.59	0.61	0.63
30	0.65	0.67	0.70	0.72	0.74	0.76	0.78	0.80	0.83	0.85
40	0.87	0.89	0.91	0.93	0.96	0.98	1.00	1.02	1.04	1.07
50	1.09	1.11	1.13	1.15	1.17	1.20	1.22	1.24	1.26	1.28
60	1.30	1.33	1.35	1.37	1.39	1.41	1.43	1.46	1.48	1.50
70	1.52	1.54	1.57	1.59	1.61	1.63	1.65	1.67	1.70	1.72
80	1.74	1.76	1.78	1.80	1.83	1.85	1.87	1.89	1.91	1.93
90	1.96	1.98	2.00	2.02	2.04	2.06	2.09	2.11	2.13	2.15
100	2.17	2.20	2.22	2.24	2.26	2.28	2.30	2.33	2.35	2.37
110	2.39	2.41	2.43	2.46	2.48	2.50	2.52	2.54	2.56	2.59
120	2.61	2.63	2.65	2.67	2.70	2.72	2.74	2.76	2.78	2.80
130	2.83	2.85	2.87	2.89	2.91	2.93	2.96	2.98	3.00	3.02
140	3.04	3.06	3.09	3.11	3.13	3.15	3.17	3.20	3.22	3.24
150	3.26	3.28	3.30	3.33	3.35	3.37	3.39	3.41	3.43	3.46
160	3.48	3.50	3.52	3.54	3.56	3.59	3.61	3.63	3.65	3.67
170	3.70	3.72	3.74	3.76	3.78	3.80	3.83	3.85	3.87	3.89
180	3.91	3.93	3.96	3.98	4.00	4.02	4.04	4.06	4.09	4.11
190	4.13	4.15	4.17	4.20	4.22	4.24	4.26	4.28	4.30	4.33
200	4.35	4.37	4.39	4.41	4.43	4.46	4.48	4.50	4.52	4.54

TABLE 36

Nitrate

Conversion from micrograms per liter of NO_3 to microgram-atoms per liter of $\text{NO}_3\text{-N}$

Micrograms per liter of NO_3	00	01	02	03	04	05	06	07	08	09
00	00.0	00.0	00.0	00.0	00.1	00.1	00.1	00.1	00.1	00.1
10	00.2	00.2	00.2	00.2	00.2	00.2	00.3	00.3	00.3	00.3
20	00.3	00.3	00.4	00.4	00.4	00.4	00.4	00.4	00.5	00.5
30	00.5	00.5	00.5	00.5	00.5	00.6	00.6	00.6	00.6	00.6
40	00.6	00.7	00.7	00.7	00.7	00.7	00.7	00.8	00.8	00.8
50	00.8	00.8	00.8	00.9	00.9	00.9	00.9	00.9	00.9	01.0
60	01.0	01.0	01.0	01.0	01.0	01.0	01.1	01.1	01.1	01.1
70	01.1	01.1	01.2	01.2	01.2	01.2	01.2	01.2	01.3	01.3
80	01.3	01.3	01.3	01.3	01.4	01.4	01.4	01.4	01.4	01.4
90	01.5	01.5	01.5	01.5	01.5	01.5	01.5	01.6	01.6	01.6
Micrograms per liter of NO_3	00	10	20	30	40	50	60	70	80	90
100	01.6	01.8	01.9	02.1	02.3	02.4	02.6	02.7	02.9	03.1
200	03.2	03.4	03.5	03.7	03.9	04.0	04.2	04.4	04.5	04.7
300	04.8	05.0	05.2	05.3	05.5	05.6	05.8	06.0	06.1	06.3
400	06.5	06.6	06.8	06.9	07.1	07.3	07.4	07.6	07.7	07.9
500	08.1	08.2	08.4	08.5	08.7	08.9	09.0	09.2	09.4	09.5
600	09.7	09.8	10.0	10.2	10.3	10.5	10.6	10.8	11.0	11.1
700	11.3	11.5	11.6	11.8	11.9	12.1	12.3	12.4	12.6	12.7
800	12.9	13.1	13.2	13.4	13.5	13.7	13.9	14.0	14.2	14.4
900	14.5	14.7	14.8	15.0	15.2	15.3	15.5	15.6	15.8	16.0
1000	16.1	16.3	16.5	16.6	16.8	16.9	17.1	17.3	17.4	17.6
1100	17.7	17.9	18.1	18.2	18.4	18.5	18.7	18.9	19.0	19.2
1200	19.4	19.5	19.7	19.8	20.0	20.2	20.3	20.5	20.6	20.8
1300	21.0	21.1	21.3	21.4	21.6	21.8	21.9	22.1	22.3	22.4
1400	22.6	22.7	22.9	23.1	23.2	23.4	23.5	23.7	23.9	24.0
1500	24.2	24.4	24.5	24.7	24.8	25.0	25.2	25.3	25.5	25.6
1600	25.8	26.0	26.1	26.3	26.4	26.6	26.8	26.9	27.1	27.3
1700	27.4	27.6	27.7	27.9	28.1	28.2	28.4	28.5	28.7	28.9
1800	29.0	29.2	29.4	29.5	29.7	29.8	30.0	30.2	30.3	30.5
1900	30.6	30.8	31.0	31.1	31.3	31.4	31.6	31.8	31.9	32.1
2000	32.3	32.4	32.6	32.7	32.9	33.1	33.2	33.4	33.5	33.7

TABLE 36 (Cont'd)

Nitrate

Conversion from micrograms per liter of NO_3 to microgram-atoms per liter of $\text{NO}_3\text{-N}$

Micrograms per liter of NO_3	00	10	20	30	40	50	60	70	80	90
2100	33.9	34.0	34.2	34.4	34.5	34.7	34.8	35.0	35.2	35.3
2200	35.5	35.6	35.8	36.0	36.1	36.3	36.4	36.6	36.8	36.9
2300	37.1	37.3	37.4	37.6	37.7	37.9	38.1	38.2	38.4	38.5
2400	38.7	38.9	39.0	39.2	39.4	39.5	39.7	39.8	40.0	40.2
2500	40.3	40.5	40.6	40.8	41.0	41.1	41.3	41.4	41.6	41.8
2600	41.9	42.1	42.3	42.4	42.6	42.7	42.9	43.1	43.2	43.4
2700	43.5	43.7	43.9	44.0	44.2	44.4	44.5	44.7	44.8	45.0
2800	45.2	45.3	45.5	45.6	45.8	46.0	46.1	46.3	46.4	46.6
2900	46.8	46.9	47.1	47.3	47.4	47.6	47.7	47.9	48.1	48.2
3000	48.4	48.5	48.7	48.9	49.0	49.2	49.4	49.5	49.7	49.8

NOTE: Conversion of values not given directly in the tables are derived by addition.

TABLE 37

Nitrogen

Conversion from micrograms per liter of N to microgram-atoms per liter of N.

(1 μg of N = 0.0713944 $\mu\text{g-at}$ of N)Micrograms
per liter
of N.00-.07 .08-.21 .22-.35 .36-.49 .50-.63 .64-.77 .78-.91 .92-.99

0.0 0.00 0.01 0.02 0.03 0.04 0.05 0.06 0.07

Micrograms
per liter
of N0.00 1.00 2.00 3.00 4.00 5.00 6.00 7.00 8.00 9.00

00	0.00	0.07	0.14	0.21	0.29	0.36	0.43	0.50	0.57	0.64
10	0.71	0.79	0.86	0.93	1.00	1.07	1.14	1.21	1.29	1.36
20	1.43	1.50	1.57	1.64	1.71	1.78	1.86	1.93	2.00	2.07
30	2.14	2.21	2.28	2.36	2.43	2.50	2.57	2.64	2.71	2.78
40	2.86	2.93	3.00	3.07	3.14	3.21	3.28	3.36	3.43	3.50
50	3.57	3.64	3.71	3.78	3.86	3.93	4.00	4.07	4.14	4.21
60	4.28	4.36	4.43	4.50	4.57	4.64	4.71	4.78	4.85	4.93
70	5.00	5.07	5.14	5.21	5.28	5.35	5.43	5.50	5.57	5.64
80	5.71	5.78	5.85	5.93	6.00	6.07	6.14	6.21	6.28	6.35
90	6.43	6.50	6.57	6.64	6.71	6.78	6.85	6.93	7.00	7.07
100	7.14	7.21	7.28	7.35	7.43	7.50	7.57	7.64	7.71	7.78
110	7.85	7.92	8.00	8.07	8.14	8.21	8.28	8.35	8.42	8.50
120	8.57	8.64	8.71	8.78	8.85	8.92	9.00	9.07	9.14	9.21
130	9.28	9.35	9.42	9.50	9.57	9.64	9.71	9.78	9.85	9.92
140	10.00	10.07	10.14	10.21	10.28	10.35	10.42	10.49	10.57	10.64
150	10.71	10.78	10.85	10.92	10.99	11.07	11.14	11.21	11.28	11.35
160	11.42	11.49	11.57	11.64	11.71	11.77	11.85	11.92	11.99	12.06
170	12.14	12.21	12.28	12.35	12.42	12.49	12.56	12.64	12.71	12.78
180	12.85	12.92	12.99	13.06	13.14	13.21	13.28	13.35	13.42	13.49
190	13.56	13.64	13.71	13.78	13.85	13.92	13.99	14.06	14.14	14.21
200	14.28	14.35	14.42	14.49	14.56	14.64	14.71	14.78	14.85	14.92
210	14.99	15.06	15.14	15.21	15.28	15.35	15.42	15.49	15.56	15.64
220	15.71	15.78	15.85	15.92	15.99	16.06	16.14	16.21	16.28	16.35
230	16.42	16.49	16.56	16.63	16.71	16.78	16.85	16.92	16.99	17.06
240	17.13	17.21	17.28	17.35	17.42	17.49	17.56	17.63	17.71	17.78
250	17.85	17.92	17.99	18.06	18.13	18.21	18.28	18.35	18.42	18.49

TABLE 37 (Cont'd)

Nitrogen

Conversion from micrograms per liter of N to microgram-atoms per liter of N.

(1 μg of N = 0.0713944 $\mu\text{g-at}$ of N)

Micrograms per liter of N	0.0	1.0	2.0	3.0	4.0	5.0	6.0	7.0	8.0	9.0
260	18.56	18.63	18.71	18.78	18.85	18.92	18.99	19.06	19.13	19.21
270	19.28	19.35	19.42	19.49	19.56	19.63	19.70	19.78	19.85	19.92
280	19.99	20.06	20.13	20.20	20.28	20.35	20.42	20.49	20.56	20.63
290	20.70	20.78	20.85	20.92	20.99	21.06	21.13	21.20	21.28	21.35
300	21.42	21.49	21.56	21.63	21.70	21.78	21.85	21.92	21.99	22.06
310	22.13	22.20	22.28	22.35	22.42	22.49	22.56	22.63	22.70	22.77
320	22.85	22.92	22.99	23.06	23.13	23.20	23.27	23.35	23.42	23.49
330	23.56	23.63	23.70	23.77	23.85	23.92	23.99	24.06	24.13	24.20
340	24.27	24.35	24.42	24.49	24.56	24.63	24.70	24.77	24.85	24.92
350	24.99	25.06	25.13	25.20	25.27	25.34	25.42	25.49	25.56	25.63
360	25.70	25.77	25.84	25.92	25.99	26.06	26.13	26.20	26.27	26.34
370	26.42	26.49	26.56	26.63	26.70	26.77	26.84	26.92	26.99	27.06
380	27.13	27.20	27.27	27.34	27.42	27.49	27.56	27.63	27.70	27.77
390	27.84	27.92	27.99	28.06	28.13	28.20	28.27	28.34	28.41	28.49
400	28.56	28.63	28.70	28.77	28.84	28.91	28.99	29.06	29.13	29.20
410	29.27	29.34	29.41	29.49	29.56	29.63	29.70	29.77	29.84	29.91
420	29.99	30.06	30.13	30.20	30.27	30.34	30.41	30.49	30.56	30.63
430	30.70	30.77	30.84	30.91	30.99	31.06	31.13	31.20	31.27	31.34
440	31.41	31.48	31.56	31.63	31.70	31.77	31.84	31.91	31.98	32.06
450	32.13	32.20	32.27	32.34	32.41	32.48	32.56	32.63	32.70	32.77
460	32.84	32.91	32.98	33.06	33.13	33.20	33.27	33.34	33.41	33.48
470	33.56	33.63	33.70	33.77	33.84	33.91	33.98	34.06	34.13	34.20
480	34.27	34.34	34.41	34.48	34.55	34.63	34.70	34.77	34.84	34.91
490	34.98	35.05	35.13	35.20	35.27	35.34	35.41	35.48	35.55	35.63
500	35.70	35.77	35.84	35.91	35.98	36.05	36.13	36.20	36.27	36.34

TABLE 37 (Cont'd)

Nitrogen

Conversion from micrograms per liter of N to microgram-atoms per liter of N.

(1 μg of N = 0.0713944 $\mu\text{g-at}$ of N)

Micrograms
per liter
of N

	0.0	1.0	2.0	3.0	4.0	5.0	6.0	7.0	8.0	9.0
510	36.41	36.48	36.55	36.63	36.70	36.77	36.84	36.91	36.98	37.05
520	37.13	37.20	37.27	37.34	37.41	37.48	37.55	37.62	37.70	37.77
530	37.84	37.91	37.98	38.05	38.12	38.20	38.27	38.34	38.41	38.48
540	38.55	38.62	38.70	38.77	38.84	38.91	38.98	39.05	39.12	39.20
550	39.27	39.34	39.41	39.48	39.55	39.62	39.70	39.77	39.84	39.91
560	39.98	40.05	40.12	40.20	40.27	40.34	40.41	40.48	40.55	40.62
570	40.69	40.77	40.84	40.91	40.98	41.05	41.12	41.19	41.27	41.34
580	41.41	41.48	41.55	41.62	41.69	41.77	41.84	41.91	41.98	42.05
590	42.12	42.19	42.27	42.34	42.41	42.48	42.55	42.62	42.69	42.77
600	42.84	42.91	42.98	43.05	43.12	43.19	43.27	43.34	43.41	43.48
610	43.55	43.62	43.69	43.76	43.84	43.91	43.98	44.05	44.12	44.19

NOTE: Values obtained for the amount of nitrogen in nitrate by the use of these tables are to be rounded to the nearest tenths decimal place before entering on the coding forms.

TABLE 38

Silicon

Conversion from micrograms per liter of Si to microgram-atoms per liter of Si
(1 μg of Si = 0.0356049 $\mu\text{g-atom Si}$)

Micrograms per Liter of Si	00	10	20	30	40	50	60	70	80	90
000	000	000	001	001	001	002	002	002	003	003
100	004	004	004	005	005	005	006	006	006	007
200	007	007	008	008	009	009	009	010	010	010
300	011	011	011	012	012	012	013	013	014	014
400	014	015	015	015	016	016	016	017	017	017
500	018	018	019	019	019	020	020	020	021	021
600	021	022	022	022	023	023	023	024	024	025
700	025	025	026	026	026	027	027	027	028	028
800	028	029	029	030	030	030	031	031	031	032
900	032	032	033	033	033	034	034	035	035	035

Micrograms per Liter of Si	000	100	200	300	400	500	600	700	800	900
1000	036	039	043	046	050	053	057	061	064	068
2000	071	075	078	082	085	089	093	096	100	103
3000	107	110	114	117	121	125	128	132	135	139
4000	142	146	150	153	157	160	164	1.67	171	174
5000	178	182	185	189	192	196	199	203	207	210
6000	214	217	221	224	228	231	235	239	242	246
7000	249	253	256	260	263	267	271	274	278	281
8000	285	288	292	296	299	303	306	310	313	317

EXAMPLE I:

Assume an initial value of 4200. Since this value lies within the range 1000 - 8900, use lower portion of above table. Enter left hand column at 4000, proceed horizontally to the right to column headed 200, and read 150.

EXAMPLE II:

Assume an initial value of 4180. Since this value is not recorded explicitly in the table, the conversion can be made by one of two methods:

TABLE 38 (Cont'd)

Silicon

- (1) Interpolation between 4100 and 4200 to nearest whole number, 149:
- or (2) Since $4180 = 4100 + 80$, find 146 corresponding to 4100 and 003 corresponding to 80.
Add 146 and 003 to get 149.

TABLE 39

Silicon Dioxide

Conversion from micrograms per liter of SiO_2 to microgram-atoms per liter of $\text{SiO}_2\text{-Si}$
 (1 μg of SiO_2 = 0.016643 $\mu\text{g-atom}$ of Si)

Micrograms per Liter of SiO_2	00	10	20	30	40	50	60	70	80	90
000	000	000	000	000	001	001	001	001	001	001
100	002	002	002	002	002	002	003	003	003	003
200	003	003	004	004	004	004	004	004	005	005
300	005	005	005	005	006	006	006	006	006	006
400	007	007	007	007	007	007	008	008	008	008
500	008	008	009	009	009	009	009	009	010	010
600	010	010	010	010	011	011	011	011	011	011
700	012	012	012	012	012	012	013	013	013	013
800	013	013	014	014	014	014	014	014	015	015
900	015	015	015	015	016	016	016	016	016	016

Micrograms per Liter of SiO_2	000	100	200	300	400	500	600	700	800	900
1000	017	018	020	022	023	025	027	028	030	032
2000	033	035	037	038	040	042	043	045	047	048
3000	050	052	053	055	057	058	060	062	063	065
4000	067	068	070	072	073	075	077	078	080	082
5000	083	085	087	088	090	092	093	095	097	098
6000	100	102	103	105	107	108	110	112	113	115
7000	117	118	120	121	123	125	126	128	130	131
8000	133	135	136	138	140	141	143	145	146	148
9000	150	151	153	155	156	158	160	161	163	165
10000	166	168	170	171	173	175	176	178	180	181
11000	183	185	186	188	190	191	193	195	196	198
12000	200	201	203	205	206	208	210	211	213	215

TABLE 40

Silicate

Conversion from milligrams per liter of SiO_3 to microgram-atoms per liter of $\text{SiO}_3\text{-Si}$ (1 milligram of SiO_3 = 13.1433 microgram-atoms of $\text{SiO}_3\text{-Si}$)

Milligrams per Liter of SiO_3	0.0	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9
00	000	001	003	004	005	007	008	009	011	012
01	013	014	016	017	018	020	021	022	024	025
02	026	028	029	030	032	033	034	035	037	038
03	039	041	042	043	045	046	047	049	050	051
04	053	054	055	057	058	059	060	062	063	064
05	066	067	068	070	071	072	074	075	076	078
06	079	080	081	083	084	085	087	088	089	091
07	092	093	095	096	097	099	100	101	103	104
08	105	106	108	109	110	112	113	114	116	117
09	118	120	121	122	124	125	126	127	129	130
10	131	133	134	135	137	138	139	141	142	143
11	145	146	147	149	150	151	152	154	155	156
12	158	159	160	162	163	164	166	167	168	170
13	171	172	173	175	176	177	179	180	181	183
14	184	185	187	188	189	191	192	193	195	196
15	197	198	200	201	202	204	205	206	208	209
16	210	212	213	214	216	217	218	219	221	222
17	223	225	226	227	229	230	231	233	234	235
18	237	238	239	241	242	243	244	246	247	248
19	250	251	252	254	255	256	258	259	260	262
20	263	264	265	267	268	269	271	272	273	275

TABLE 41

SUBSTITUTED CHEMISTRY

Field Containing Substitution	Code
PO ₄ -P	1
Total-P	2
NO ₂ -N	3
NO ₃ -N	4
SiO ₄ -Si	5
pH	6

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